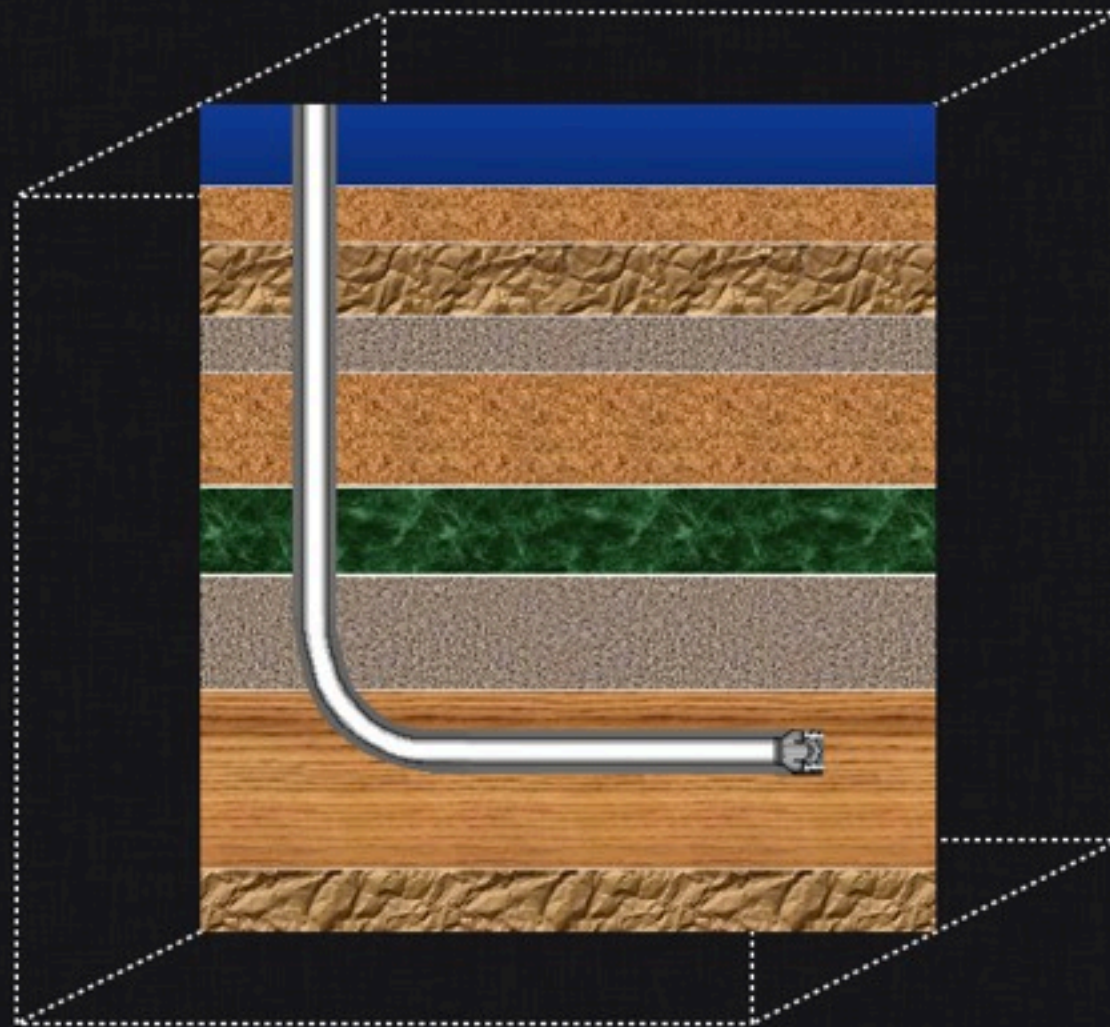


Directional Drilling Survey



Load/Save Data File

Single Well Survey

Well Planning

Multilateral Wells

Methods & Formulas

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Release 1.0

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www.wellcontrol.com.br

The Directional Drilling Survey provides the control of directional drilling of oil wells with calculations and plotting of well planning and survey data in vertical and plan views to help technicians, drillers, toolpushers and engineers of petroleum industry.

Features:

1. Well Planning Definition: Multi-Sections (until 10)
2. Ability to work with multiple data files;
3. Directional Survey: Edit, Add, Insert and Remove Survey Data;
4. Calculations Methods:
 - Tangential
 - Balanced Tangential
 - Minimum Curvature
 - Radius of Curvature
 - Angle Averaging
5. Plotting in vertical view and plan view;
6. Ability to PRINT and send reports by email;
7. Survey Data Calculations in all methods simultaneously;
8. Formulas of Methods;
9. Ability to work with length units: foot and meter;
10. Vertical Section View in portrait and Plan View in landscape.
11. Ability to Multilateral wells survey (limited to 6 wells).
12. Ability to use Initial Vertical Section and Initial Azimuth to move the KOP to initial horizontal departure.
13. Ability to X-Y-Z Plotting of a single well or multi wells (limited to 6 wells).
14. Preview plotting when selecting data files.
15. Sharing data files with iCloud.

1. [Save/Load Data File](#)
2. [Data File on iCloud](#)
3. [Load Default Data](#)
4. [Screenshots for Default Data](#)
5. [Save As](#)
6. [Open File](#)
7. [Moving the File Frame](#)

It's recommended first create a data file for work with this app => The "Save" button is enabled on views.
But this is unnecessary because this app uses data in the ram memory. The data can be saved on any time.

First, use the Local Option for create data files for better performance and after save it on iCloud.

for iCloud unavailable

Check iCloud Configuration:
Documents & Data must be ON



After create the first data file in iCloud:
Storage & Backup => Directional Survey



When TAP on “Load Default Data” the data are loaded in the RAM memory and shown in the graph X-Y-Z. Note: **No data file is created.**

Kick Off Point = 3937.01 ft
 Initial Departure = 0.00 ft
 Initial Azimuth = 0.00 degree (N0.00E)
 Initial N/S = 0.00 ft
 Initial E/W = 0.00 ft

SECTION: 1

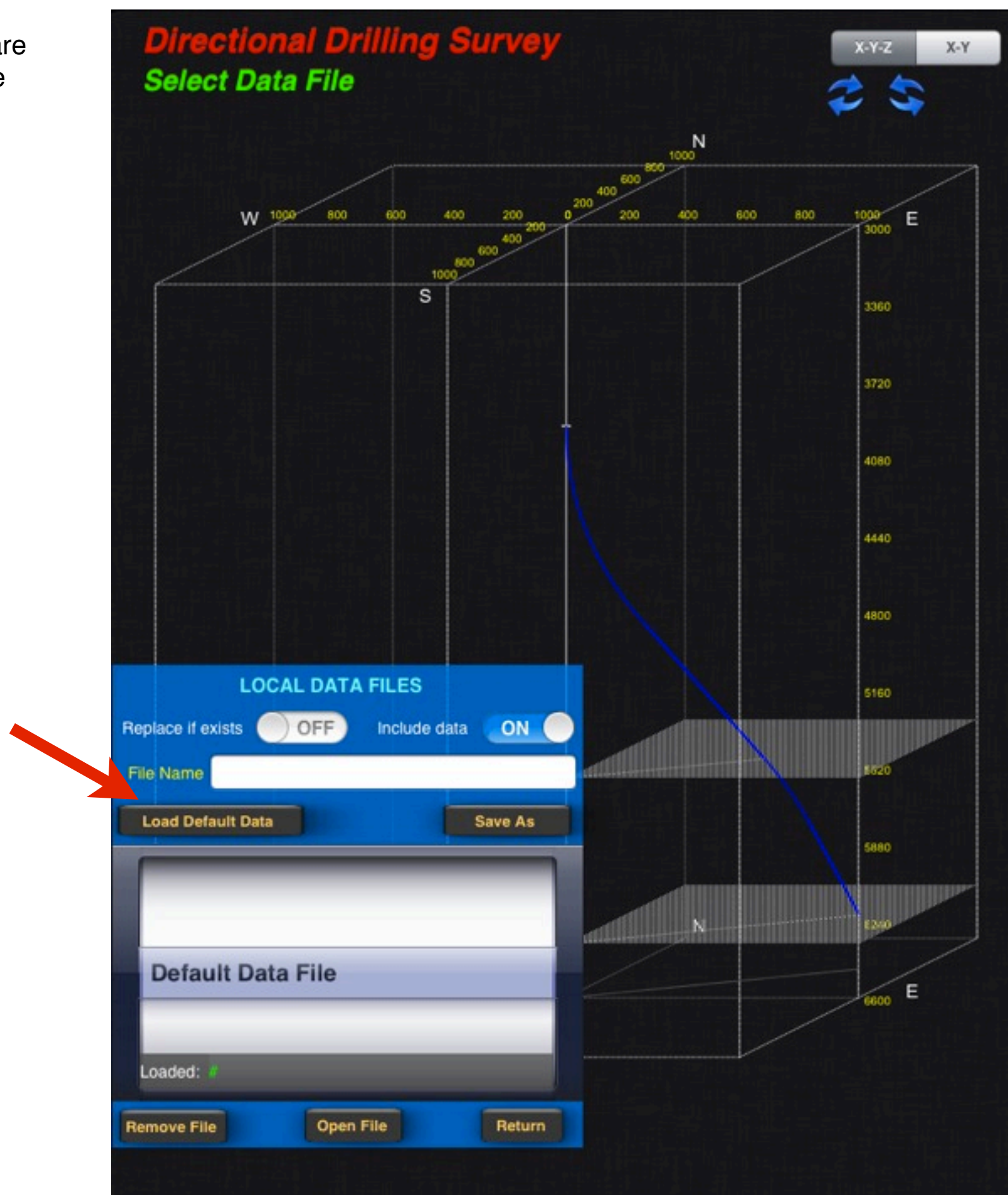
Initial TVD=3937.01 ft
 Initial MD=3937.01 ft
 Build-Up Rate= 3.0 deg/100.0 ft
 End Build-Up TVD= 4891.94 ft
 End Build-Up MD= 4937.01 ft
 Inclination=30.00 deg
 Azimuth=60.00 deg (N60.00E)
 Turn Rate=0.0 deg/0.0 ft
 End TVD = 5577.43 ft
 End MD = 5728.54 ft
 Horizontal Departure = 651.64 ft
 N/S = 325.82 ft
 E/W = 564.34 ft

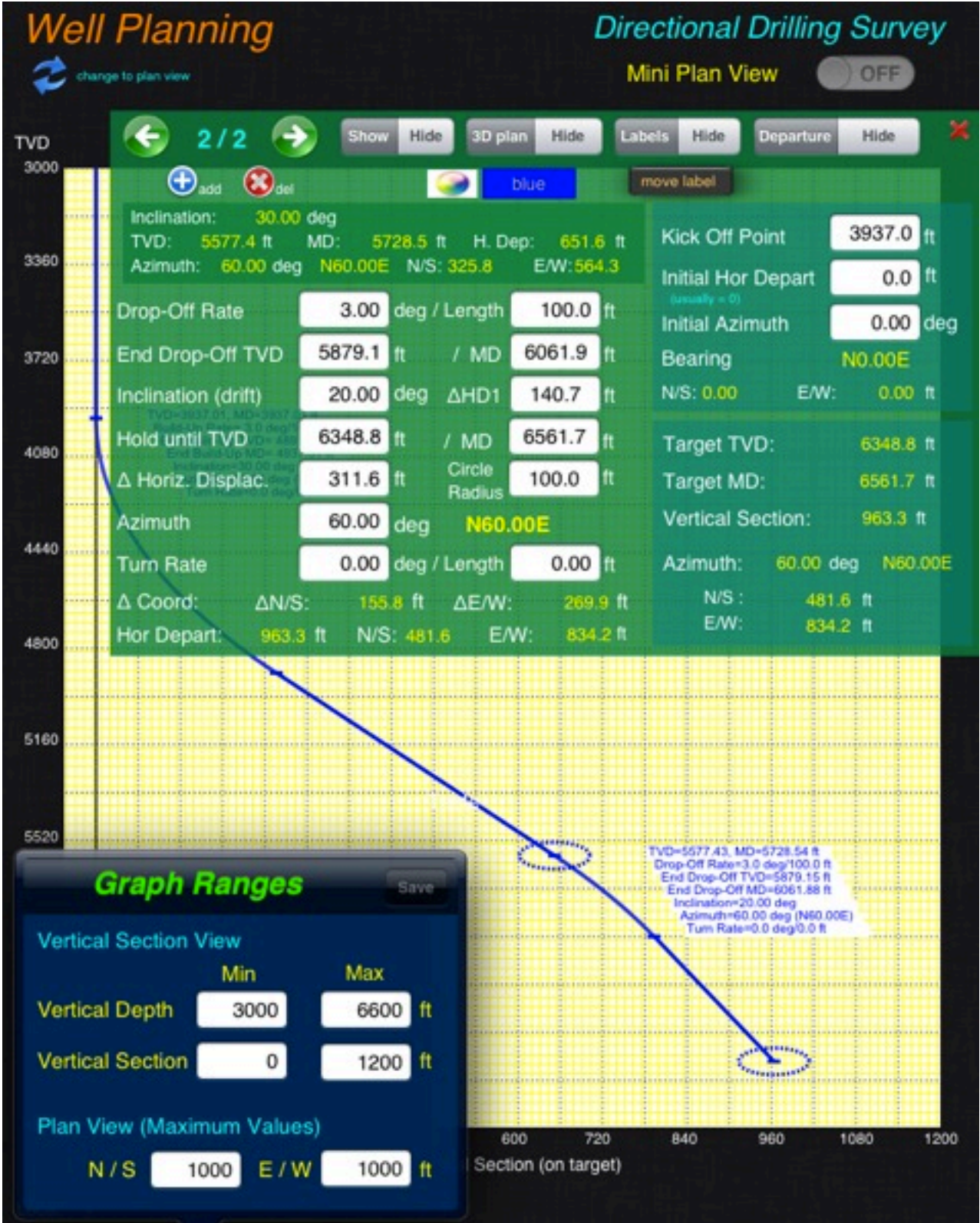
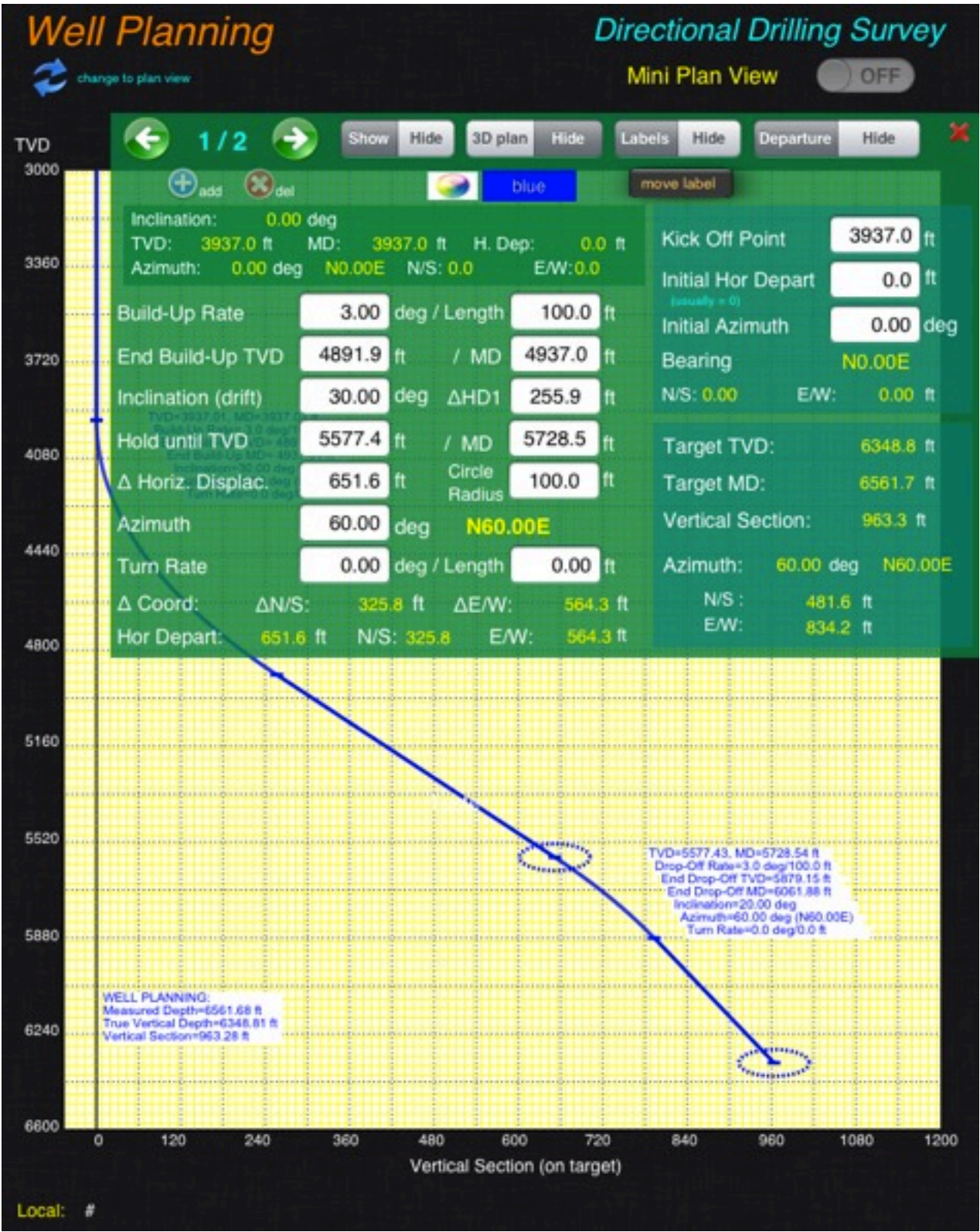
SECTION: 2

Initial TVD=5577.43 ft
 Initial MD=5728.54 ft
 Drop-Off Rate=3.0 deg/100.0 ft
 End Drop-Off TVD=5879.15 ft
 End Drop-Off MD=6061.88 ft
 Inclination=20.00 deg
 Azimuth=60.00 deg (N60.00E)
 Turn Rate=0.0 deg/0.0 ft
 End TVD = 6348.81 ft
 End MD = 6561.68 ft
 Horizontal Departure = 311.64 ft
 N/S = 155.82 ft
 E/W = 269.89 ft

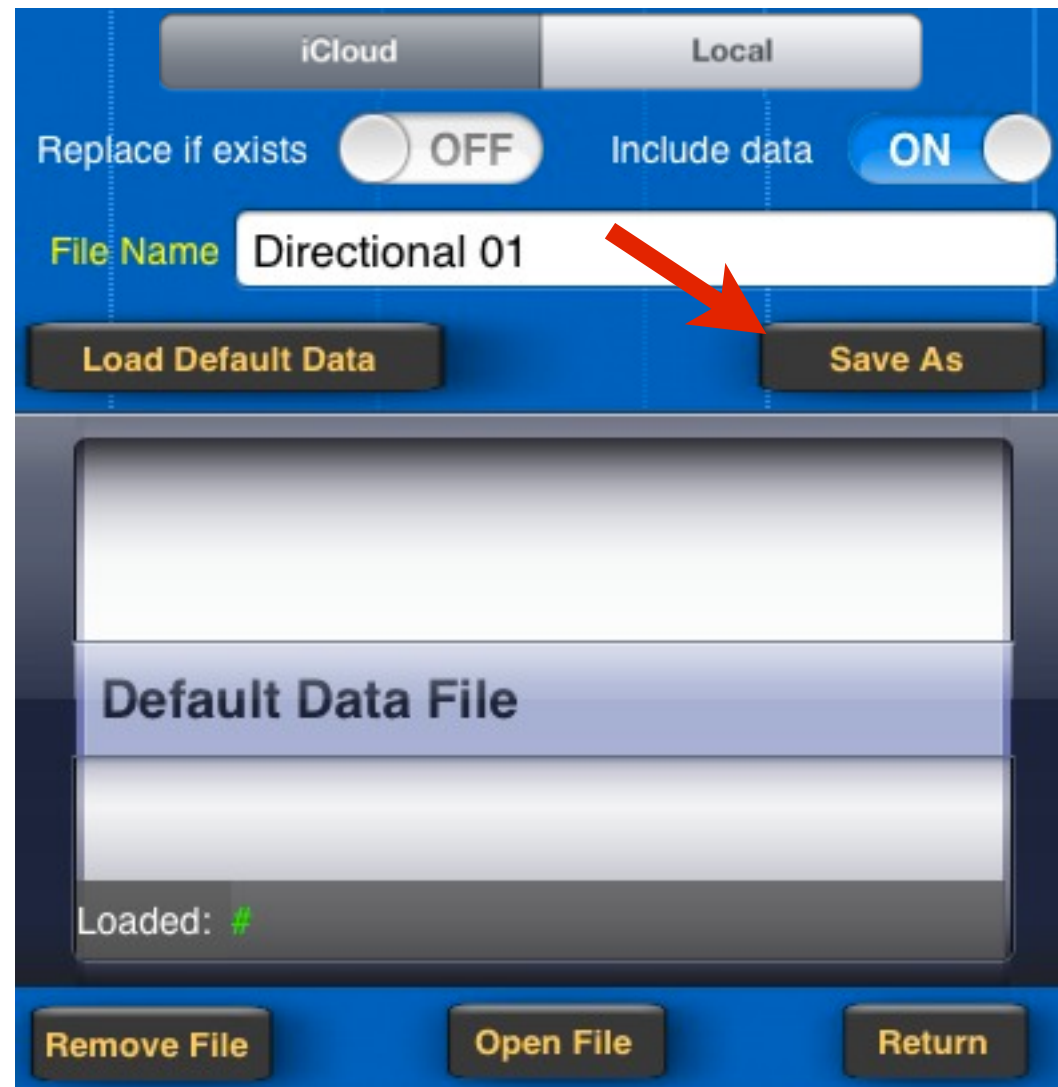
TARGET:

Measured Depth = 6561.68 ft
 True Vertical Depth = 6348.81 ft
 Vertical Section = 963.28 ft
 Target Azimuth = 60.00 degree (N60.00E)
 Target N/S = 481.64 ft
 Target E/W = 834.22 ft





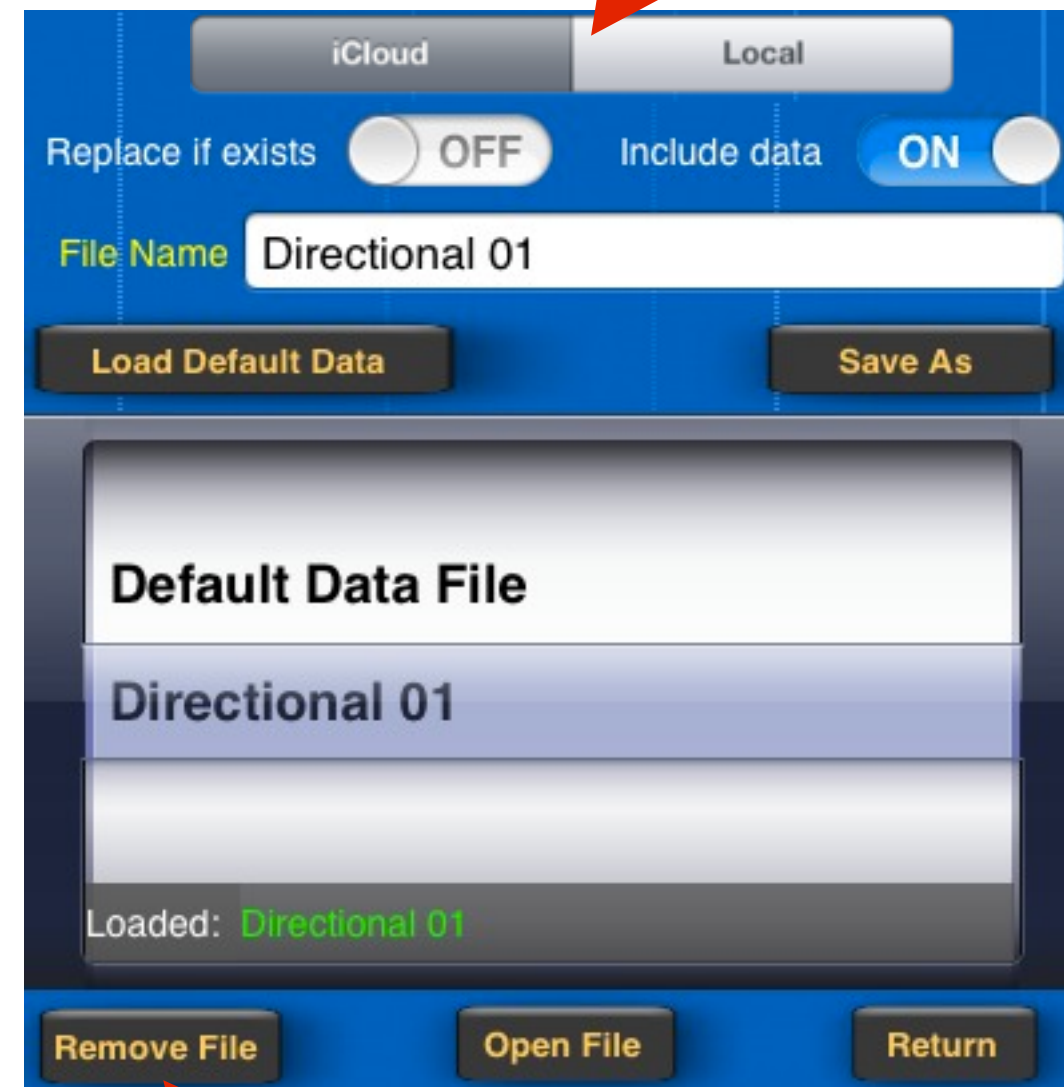
When TAP on “Save As” the data that are loaded in the RAM memory are saved to data file named with the content of File Name TextBox.



Notes:

- When the text “Loaded” is “#”, the Ram Memory is loaded with Default Data.
- Attention for “Replace if exists” option.
- Attention for “Include Data” option:
ON - Save Well Planning + Survey Data table
OFF - Save the Well Planning only

The data file is created in **iCloud** or **Local** according to the selected option.



Attention: When a data file is removed, the data is lost.



When TAP on “Open File” button, the data that are on the Data File Highlighted on Wheel are loaded in the RAM memory and can be saved with other file name.

Method for transfer data file between iCloud and Local:

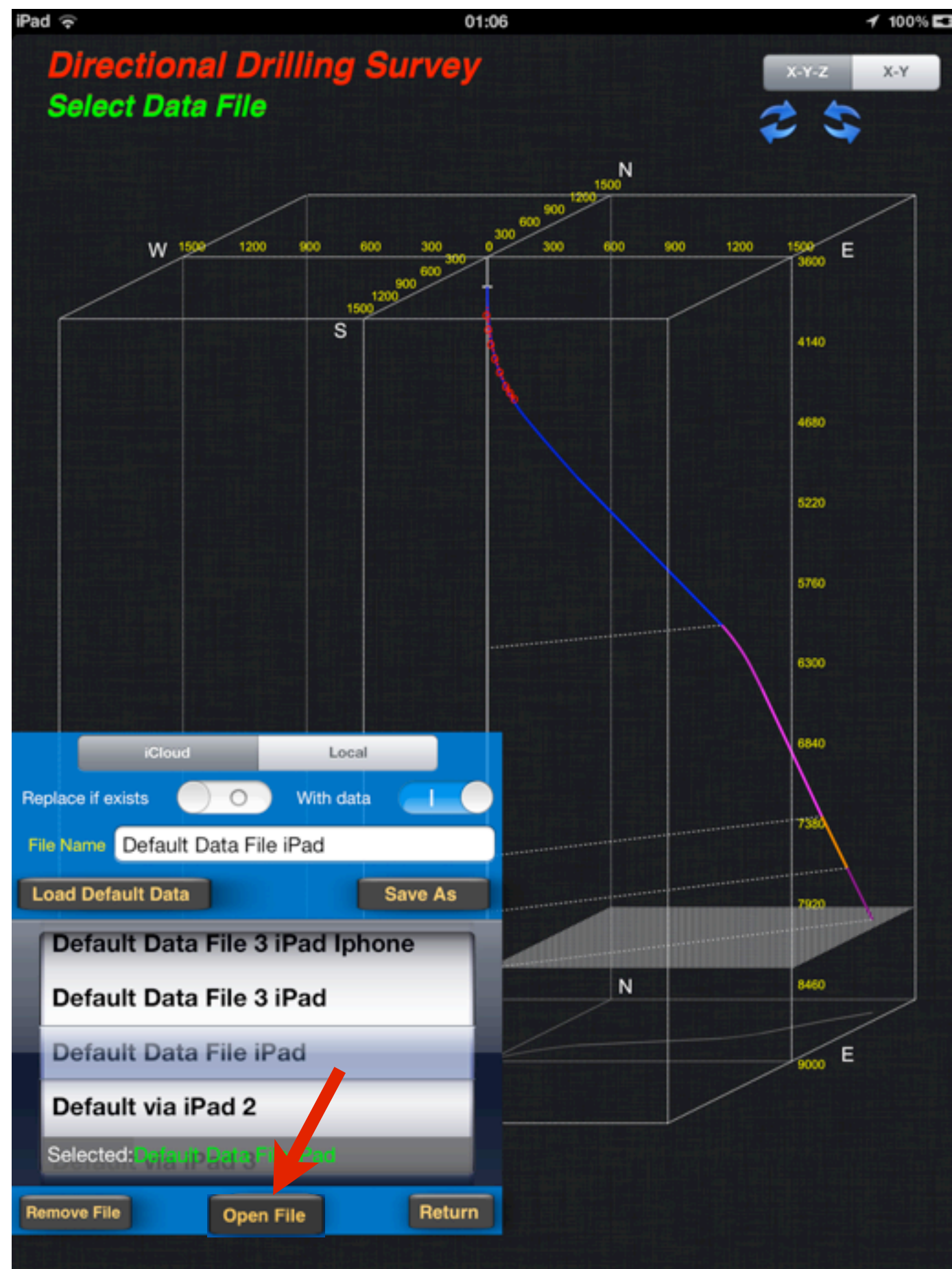
The user can open a data file on Local and after save it on iCloud or the opposite.

iCloud Message (version 2.2):

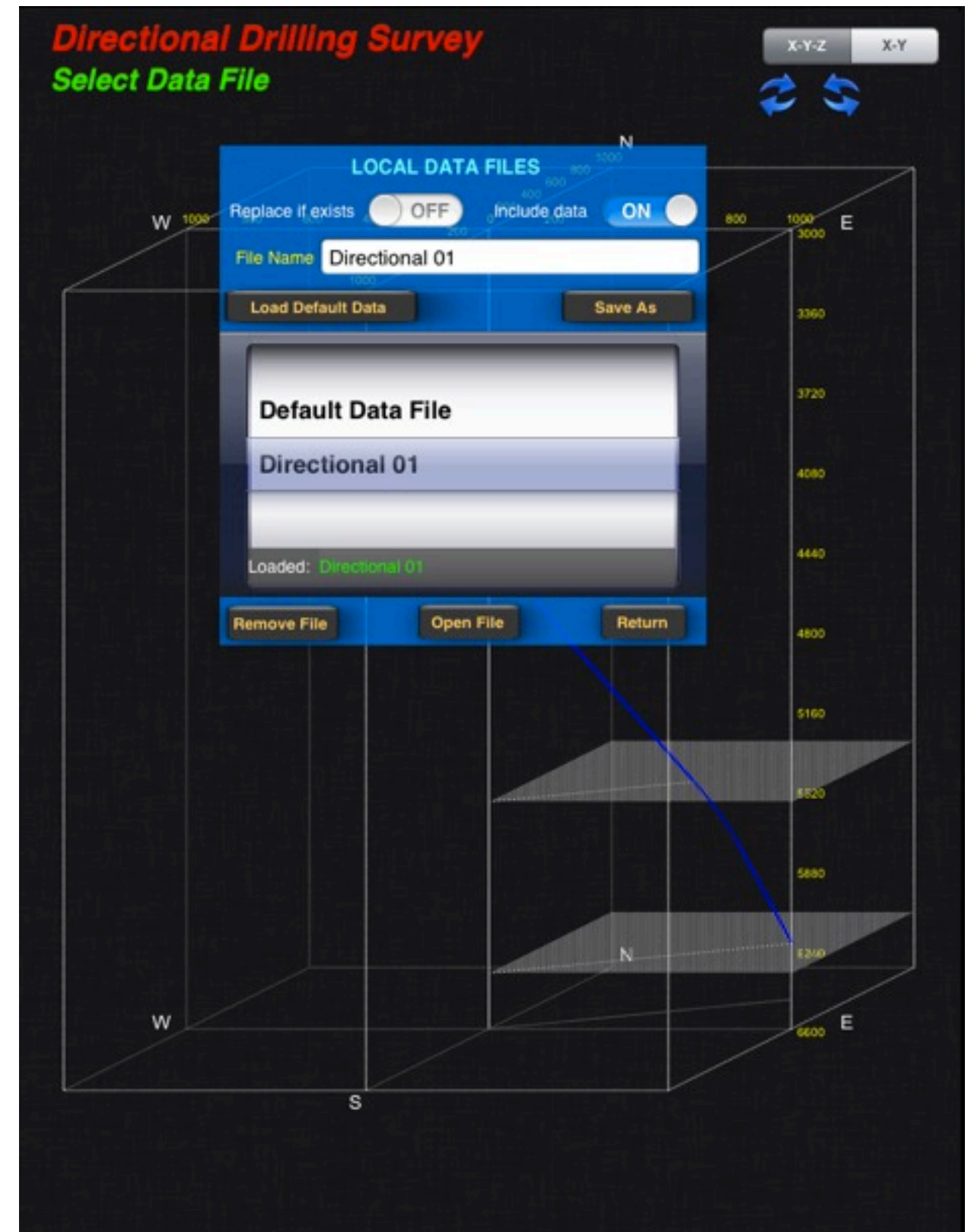
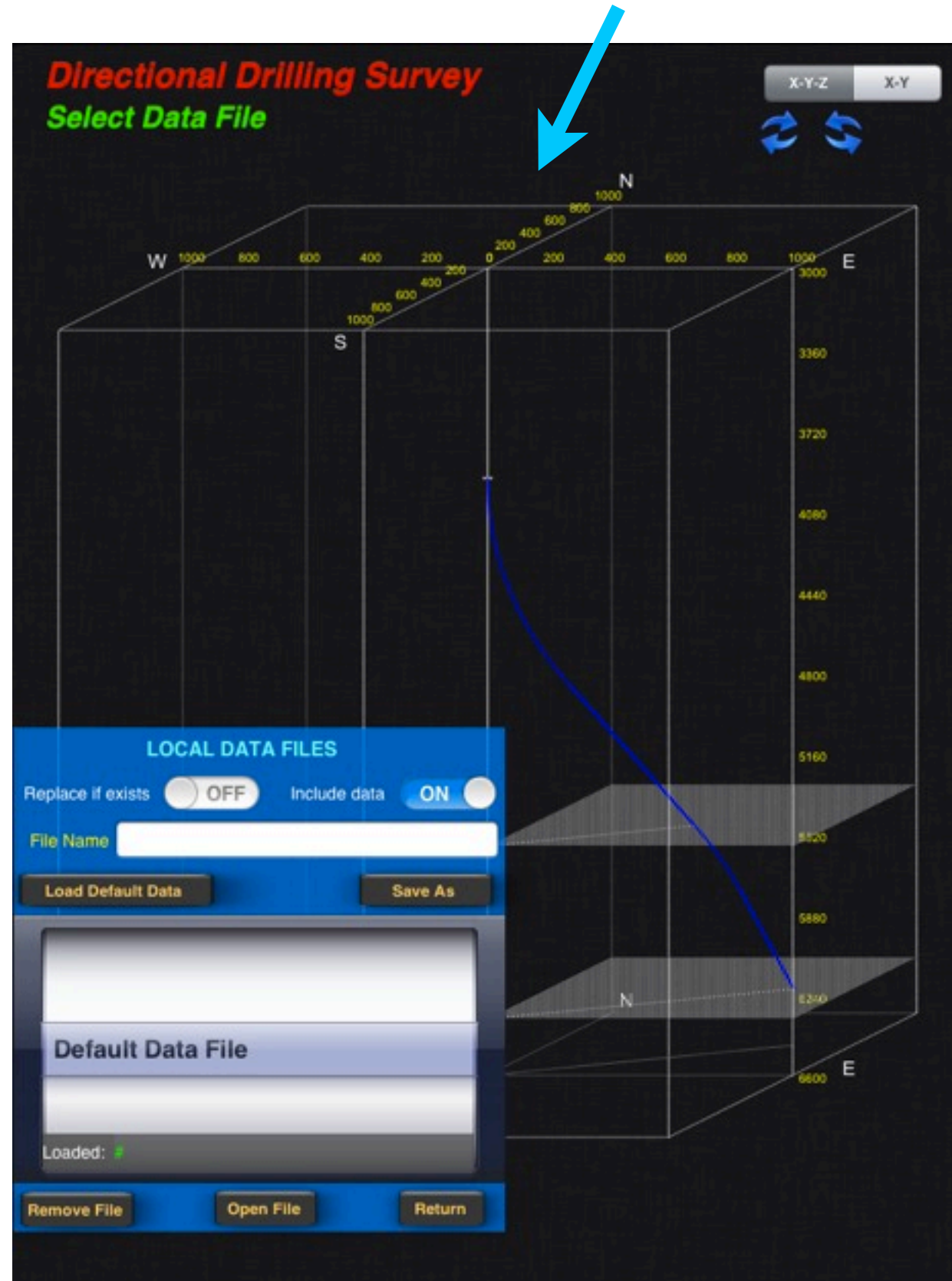


On the first time that the user taps on “Open File” button, the download of the data file is started from the iCloud to a local address with internal access only. When the download is completed, it's possible open the data file.

The user must be tap again on the “Open File” button for checking. When OK, the data file is loaded in RAM memory and shown on the graph.



TAP on any point of background to move the blue frame



1. [Well Planning](#)
2. [iPad on Portrait Position – Vertical Section](#)
3. [iPad on Landscape Position – Plan View](#)
4. [Well Config](#)
5. [Visual Options](#)
6. [Visual Option on X-Y-Z View](#)
7. [Using Initial parameters](#)
8. [Toolbar Buttons](#)
9. [Email and Print Buttons](#)
10. [Types of Wells with a single section](#)
11. [Types of Wells with multiple sections](#)
12. [Wells with multiple targets](#)
13. [Wells with multiple targets and different azimuths](#)
14. [Well with angle rate = 0 deg / 100 ft](#)
15. [Printing Well Planning](#)

The Well Planning uses Multiple Sections to build of the well. (limited to 10 sections)

Initial Data:

- Kick Off Point
- Initial Departure
- Initial Azimuth
- Initial N/S
- Initial E/W

Previous Data:

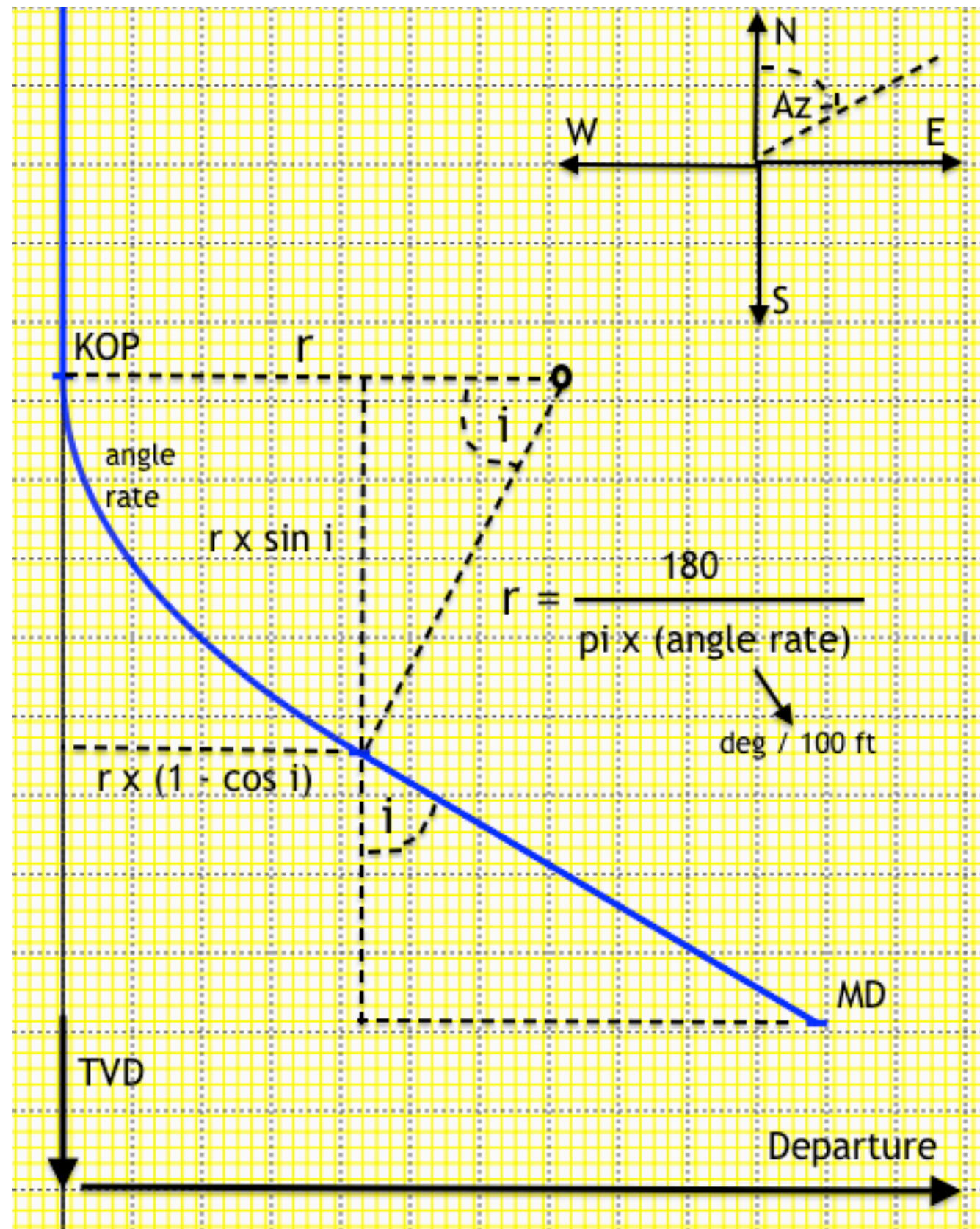
- Initial Inclination
- Initial TVD
- Initial MD
- Initial Azimuth
- Initial N/S
- Initial E/W

Section Parameters:

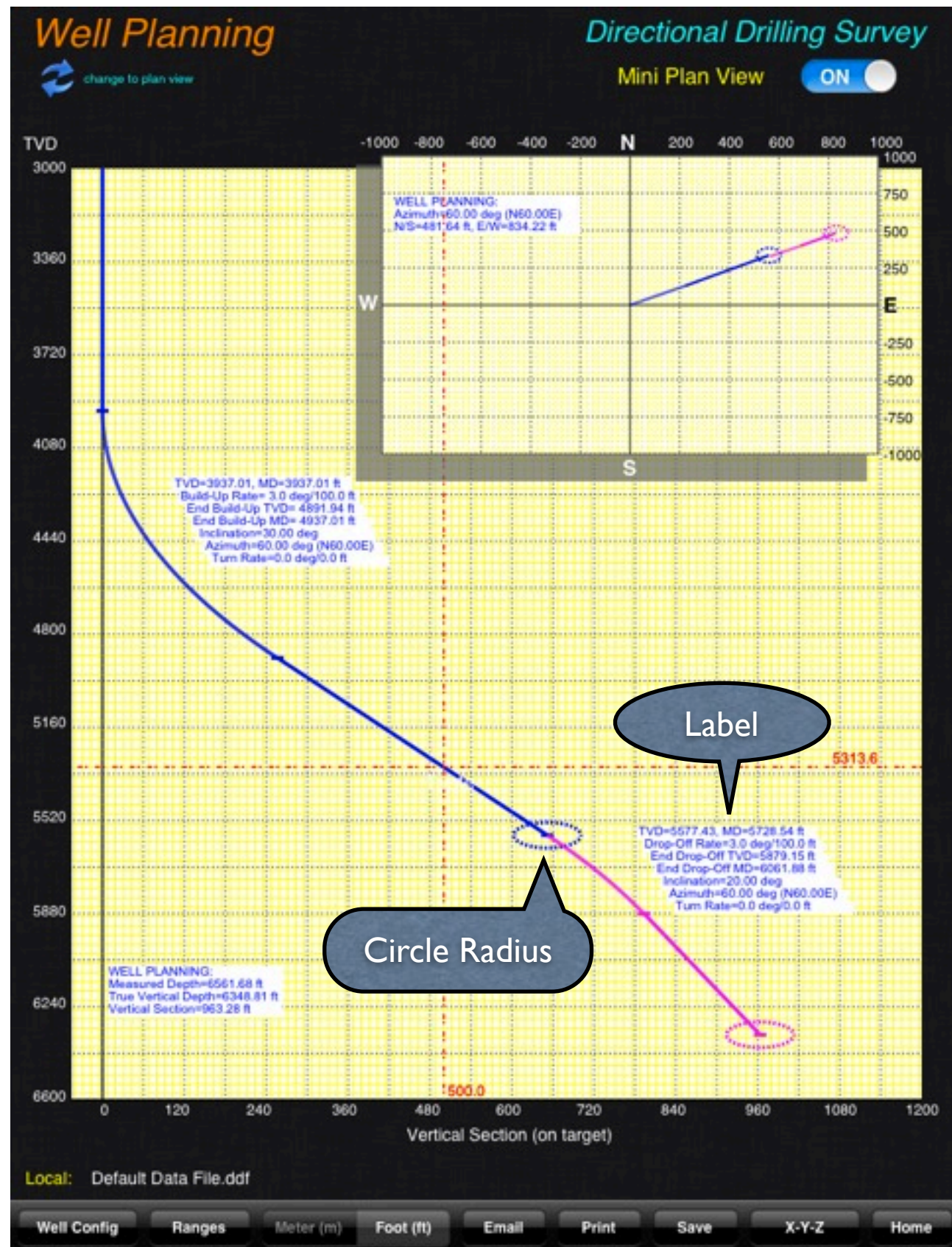
- Build-Up Rate
- End Build-Up TVD / MD
- Inclination
- Hold until TVD / MD
- Horizontal Displacement
- Azimuth
- Turn Rate
- Horizontal Departure
- N/S
- E/W

Target:

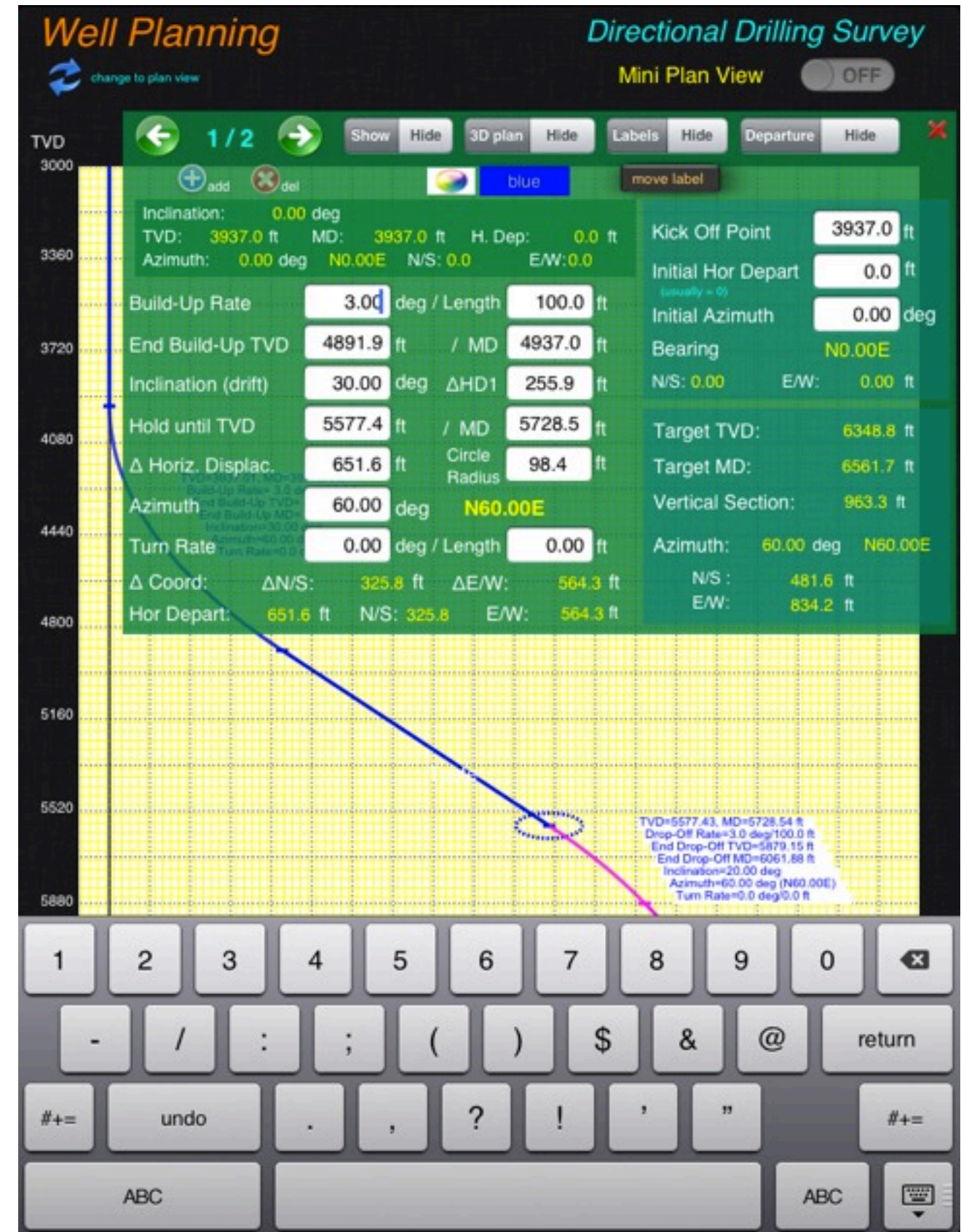
- Target TVD
- Target MD
- Vertical Section
- Target Azimuth
- Target N/S
- Target E/W



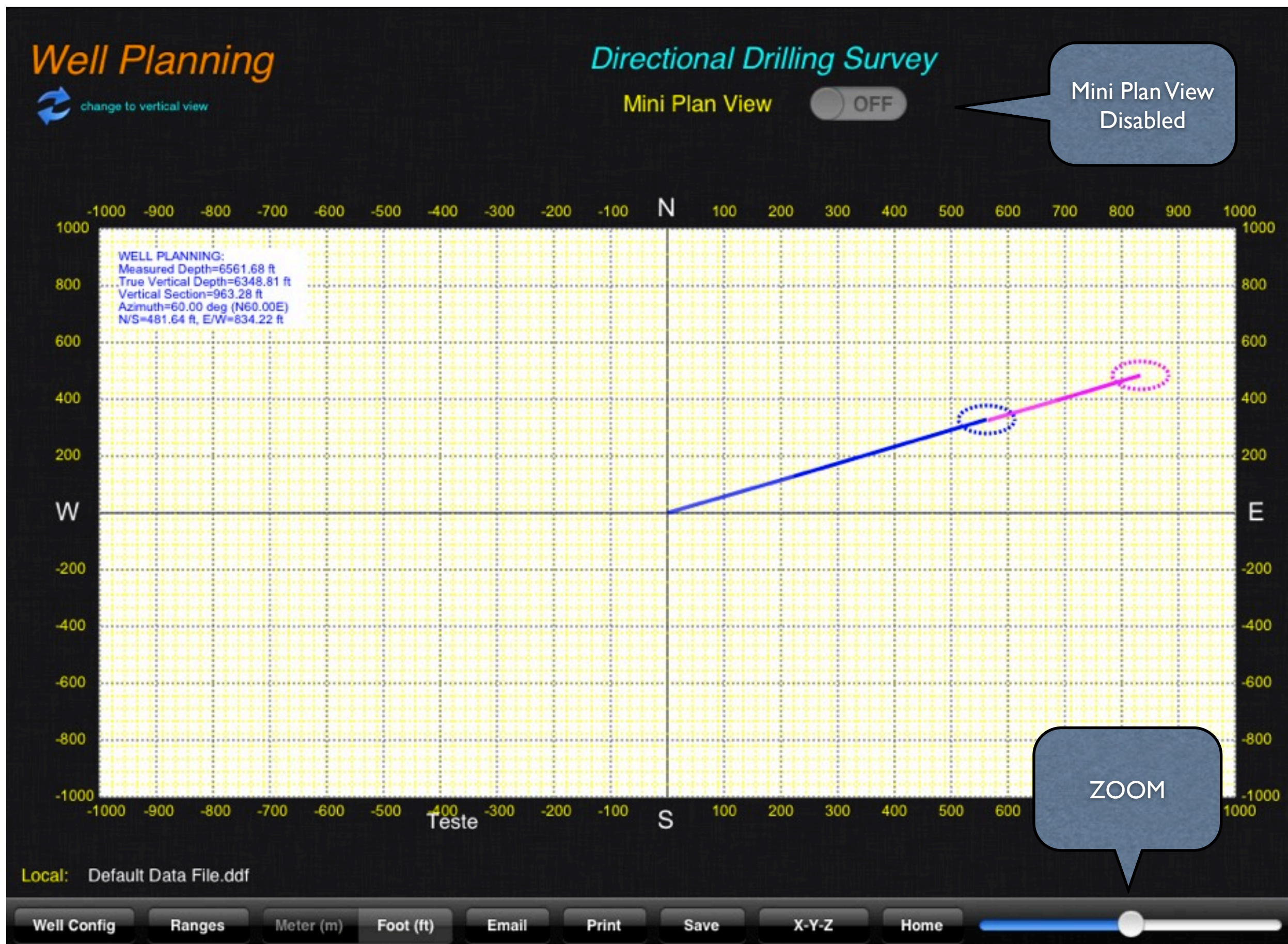
Show the Vertical View and Mini Plan View (optional)



Important: Use this position to edit parameters



Show the Plan View



← 1 / 2 → Show Hide 3D plan Hide Labels Hide Departure Hide

+ add × del blue move label

Inclination:	0.00 deg			Kick Off Point	3937.0 ft	
TVD:	3937.0 ft	MD:	3937.0 ft	H. Dep:	0.0 ft	
Azimuth:	0.00 deg	N0.00E	N/S: 0.0	E/W: 0.0		
Build-Up Rate	3.00 deg / Length	100.0 ft				
End Build-Up TVD	4891.9 ft	/ MD	4937.0 ft	Initial Hor Depart	0.0 ft	
Inclination (drift)	30.00 deg	ΔHD1	255.9 ft	Initial Azimuth	0.00 deg	
Hold until TVD	5577.4 ft	/ MD	5728.5 ft	Bearing	N0.00E	
Δ Horiz. Displac.	651.6 ft	Circle Radius	98.4 ft	N/S: 0.00	E/W: 0.00 ft	
Azimuth	60.00 deg	N60.00E				
Turn Rate	0.00 deg / Length	0.00 ft				
Δ Coord:	ΔN/S:	325.8 ft	ΔE/W:	564.3 ft	Target TVD:	6348.8 ft
Hor Depart:	651.6 ft	N/S: 325.8	E/W: 564.3 ft	Target MD:	6561.7 ft	
				Vertical Section:	963.3 ft	
				Azimuth:	60.00 deg N60.00E	
				N/S :	481.6 ft	
				E/W:	834.2 ft	

Previous

Hide

Initial

Target

Show / Hide

Well Config

Ranges

Meter (m)

Foot (ft)

Email

Print

Save

X-Y-Z

Home

Current / Total ← for Graph →

← for Graph →

1 / 2

add del

Show Hide 3D plan Hide Labels Hide Departure Hide

blue move label

Add new section Remove section

* This buttons are enabled for **Current = Total**

2 / 2

add del

Red Blue Cyan Purple Magenta Orange Yellow Green

Move the position of the label on the graph

Select the line color

TVD=1200.00, MD=1200.00 m
Build-Up Rate= 3.0 deg/30.5 m
End Build-Up TVD= 1491.06 m
End Build-Up MD= 1504.80 m
Inclination=30.00 deg
Azimuth=60.00 deg (N60.00E)
Turn Rate=0.0 deg/0.0 m

Current / Total

← 1 / 2 →

for Graph

→

ShowHide

3D planHide

LabelsHide

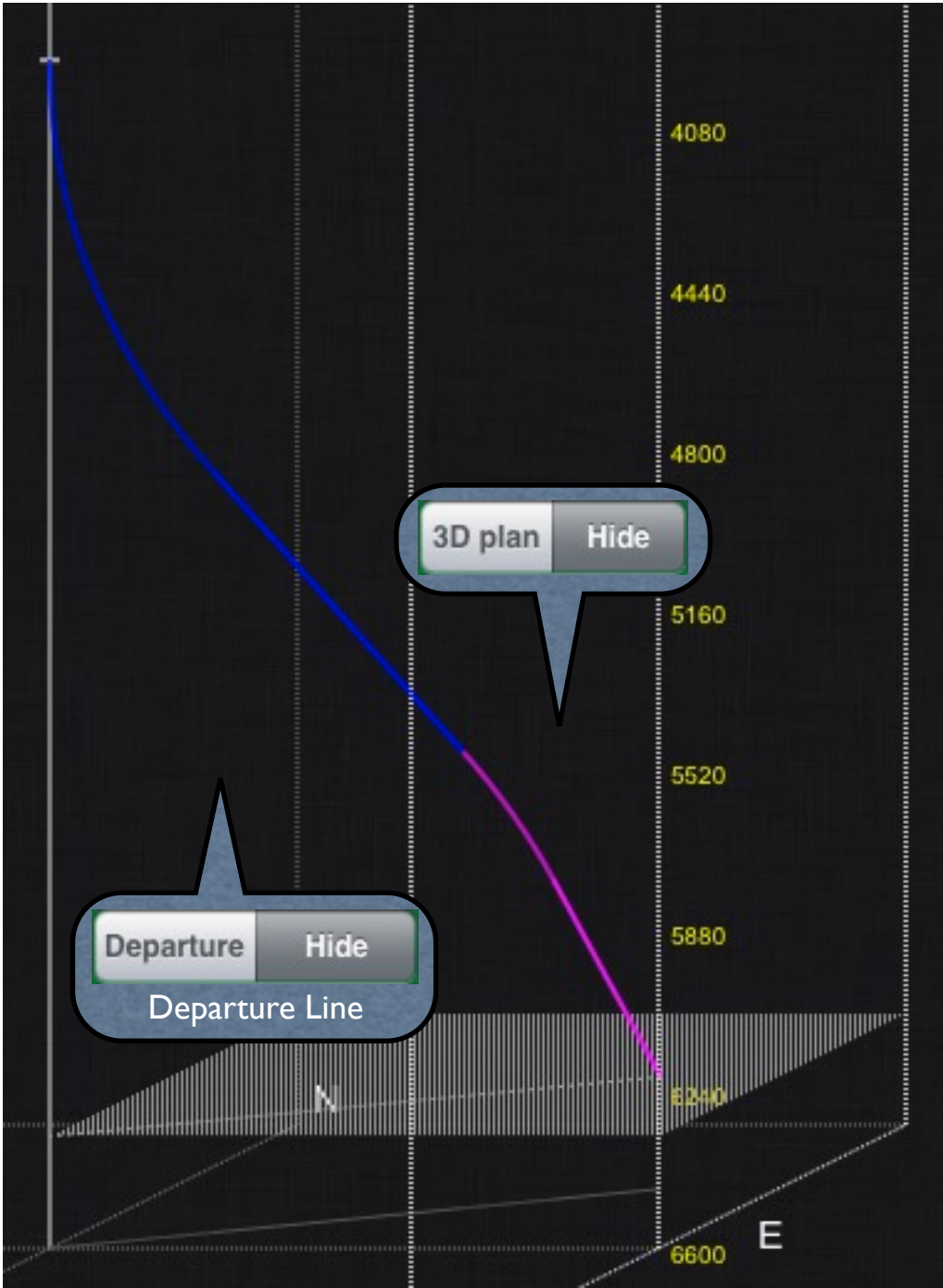
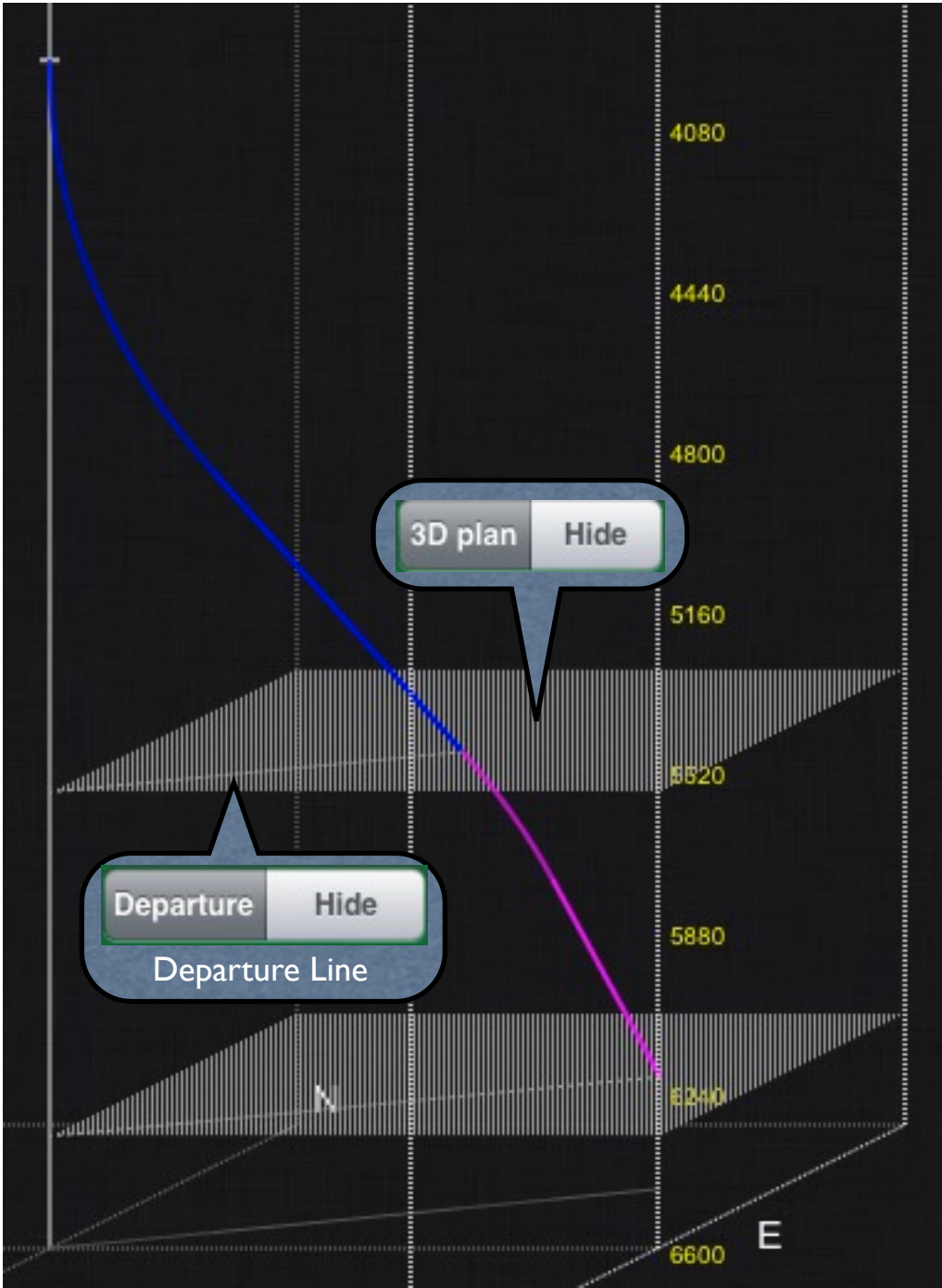
DepartureHide

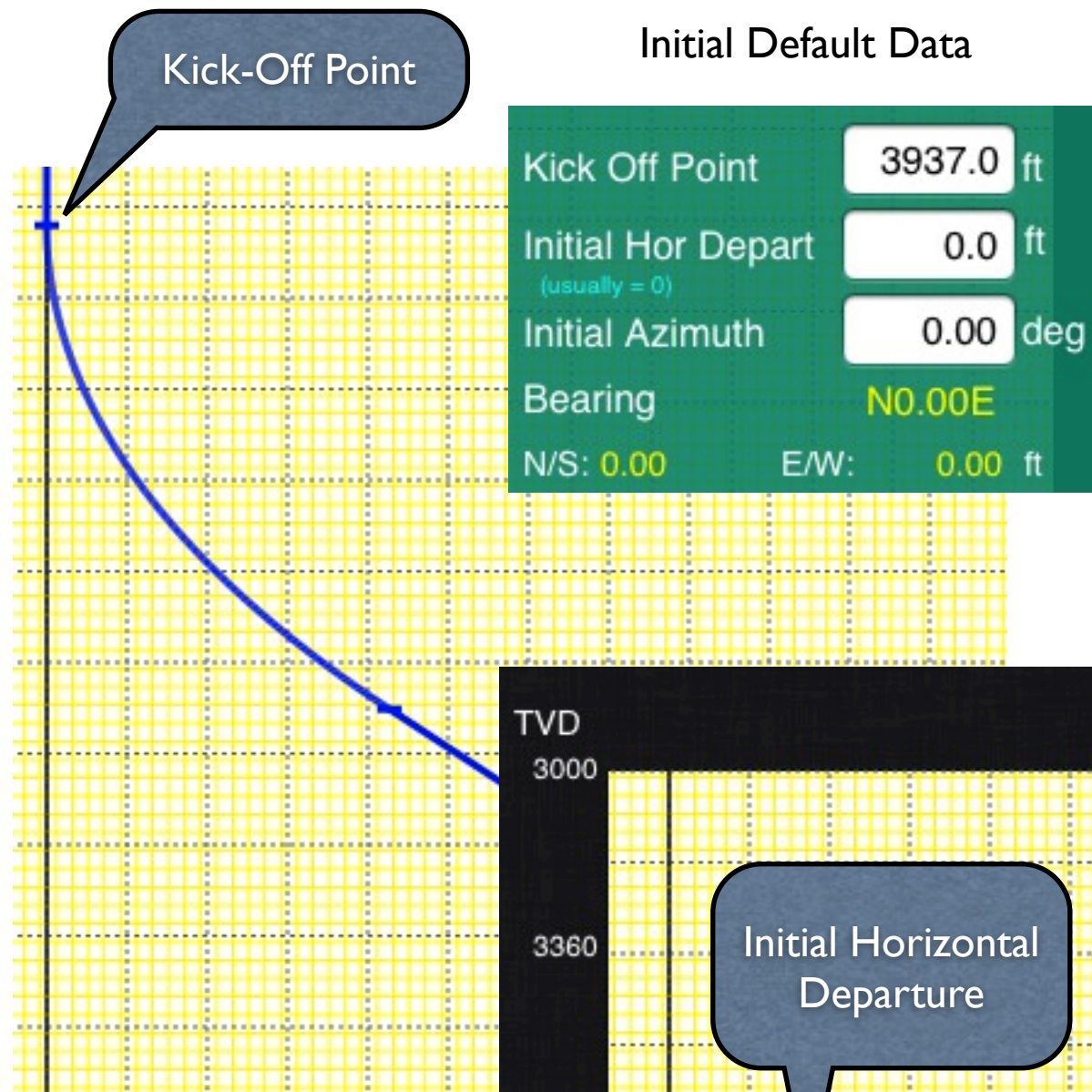
+ add

× del

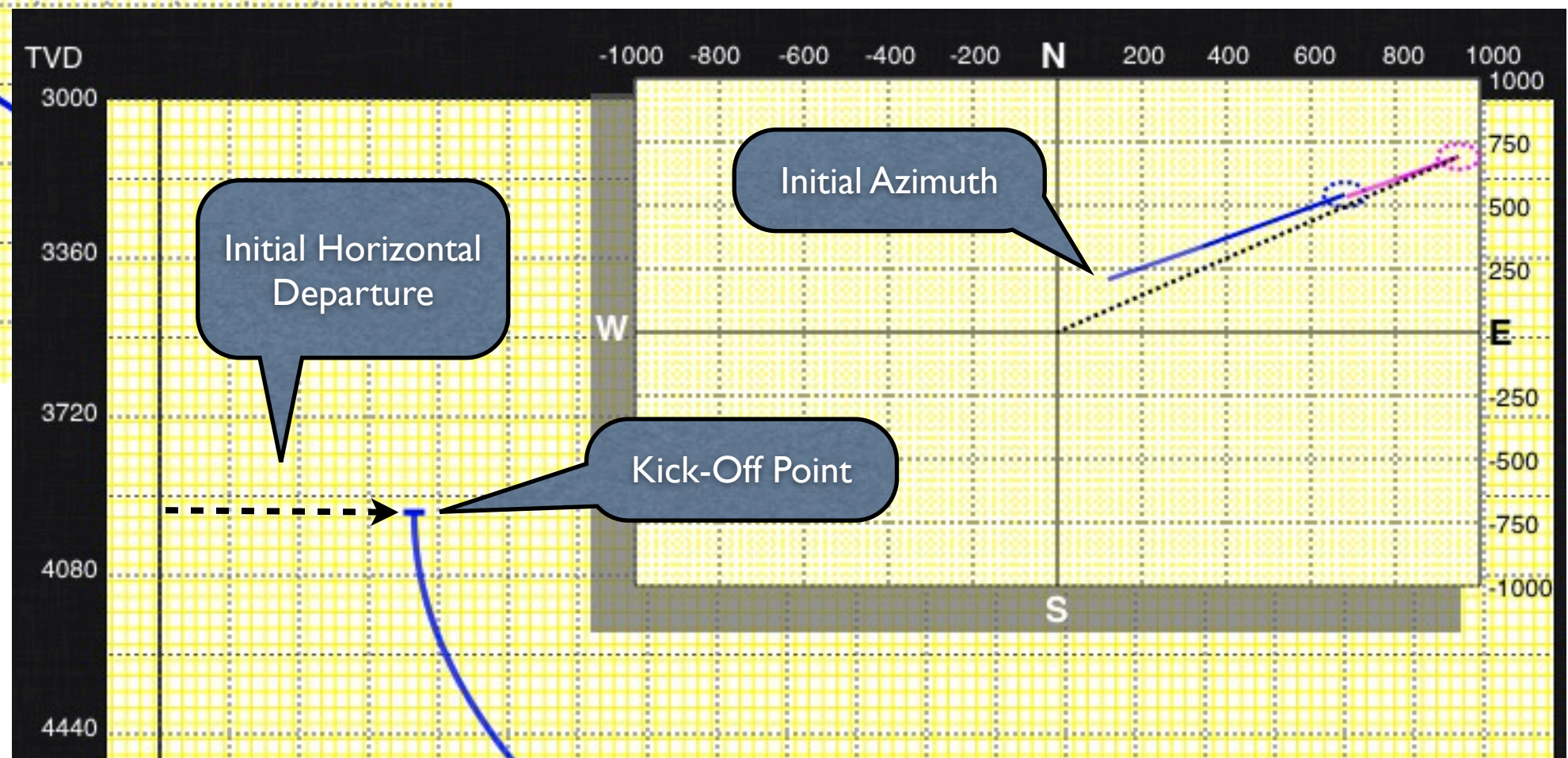
 blue

move label





Initial Horizontal Departure
and **Initial Azimuth**
are useful to plot **multiple wells**



Graph Ranges Save

Vertical Section View

	Min	Max	
Vertical Depth	3000	6600	ft
Vertical Section	0	1200	ft

Plan View (Maximum Values)

N / S	1000	E / W	1000	ft
-------	------	-------	------	----

Well Config
Ranges
Meter (m)
Foot (ft)
Email
Print
Save
X-Y-Z
Home

Return
to Home View

Local: Default Data File.ddf

Well Config
Ranges
Meter (m)
Foot (ft)
Email
Print
Save
X-Y-Z
Home

Save Button is
Enabled when
a Data File is
SELECTED

Cancel

Directional Drilling Survey - Vertical Section View

Send

To: user@mail.com

Cc/Bcc:

Images: 1.4 MB

Subject: Directional Drilling Survey - Vertical Section View

Data File: *Default Data File.ddf*

WELL PLANNING:

Kick Off Point = 3937.01 ft
Initial Departure = 0.00 ft
Initial Azimuth = 0.00 degree (N0.00E)
Initial N/S = 0.00 ft
Initial E/W = 0.00 ft

TOTAL SECTIONS: 2

SECTION: 1
Initial TVD=3937.01 ft
Initial MD=3937.01 ft
Build-Up Rate= 3.0 deg/100.0 ft
End Build-Up TVD= 4891.94 ft
End Build-Up MD= 4937.01 ft
Inclination=30.00 deg
Azimuth=60.00 deg (N60.00E)
Turn Rate=0.0 deg/0.0 ft
End TVD = 5577.43 ft
End MD = 5728.54 ft

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Printer Options

Printer

Select Printer >

1 Copy

-

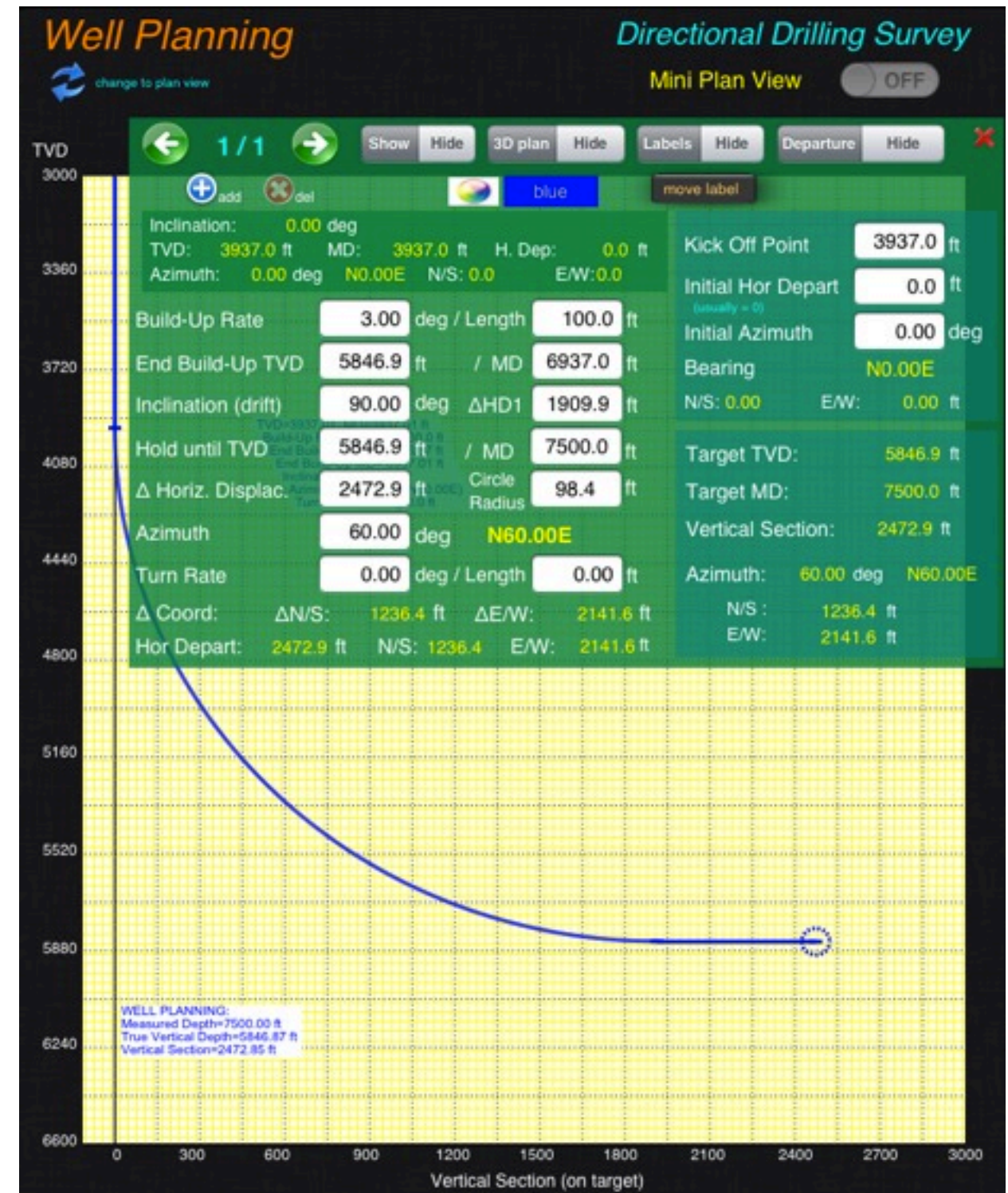
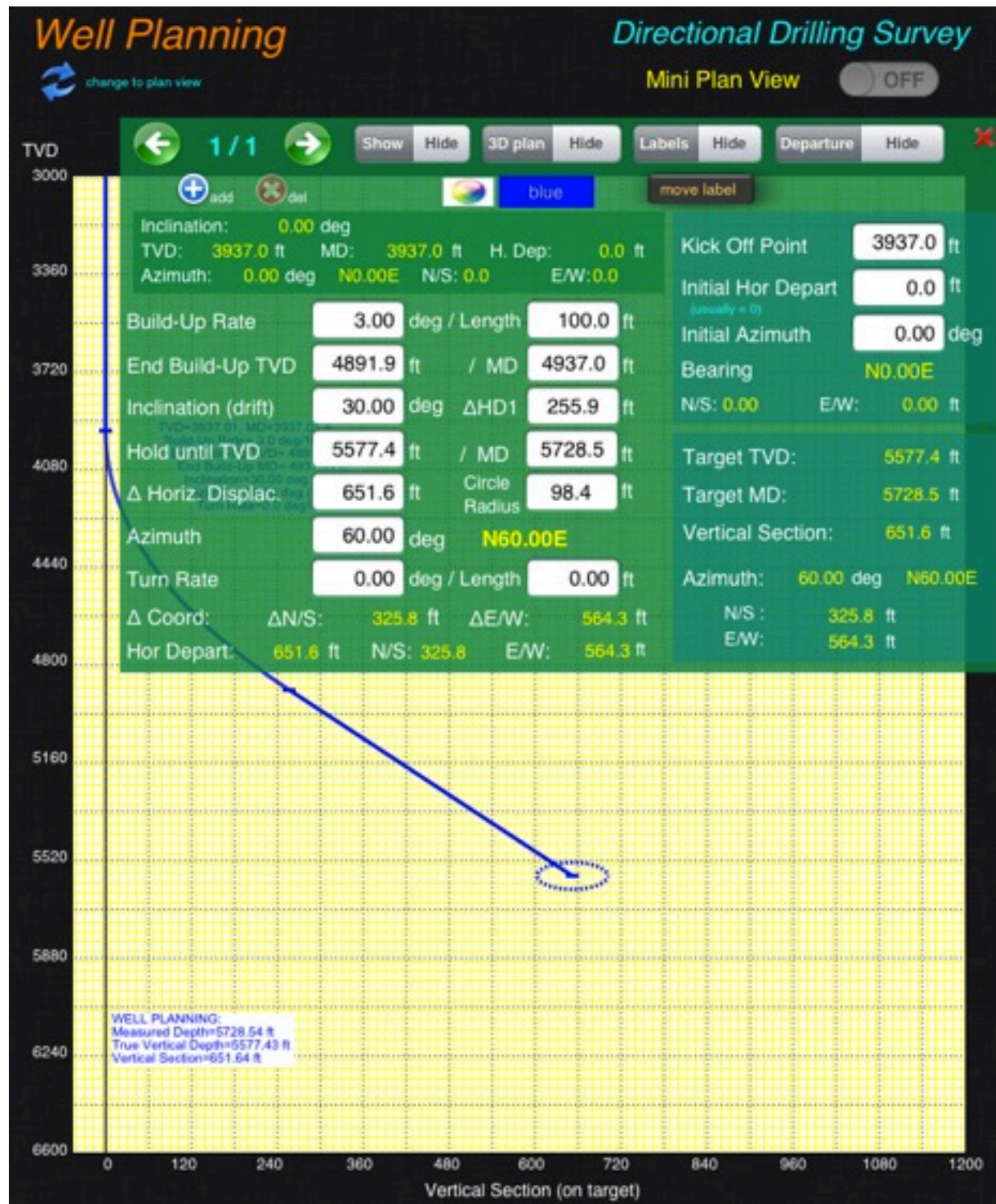
+

Print

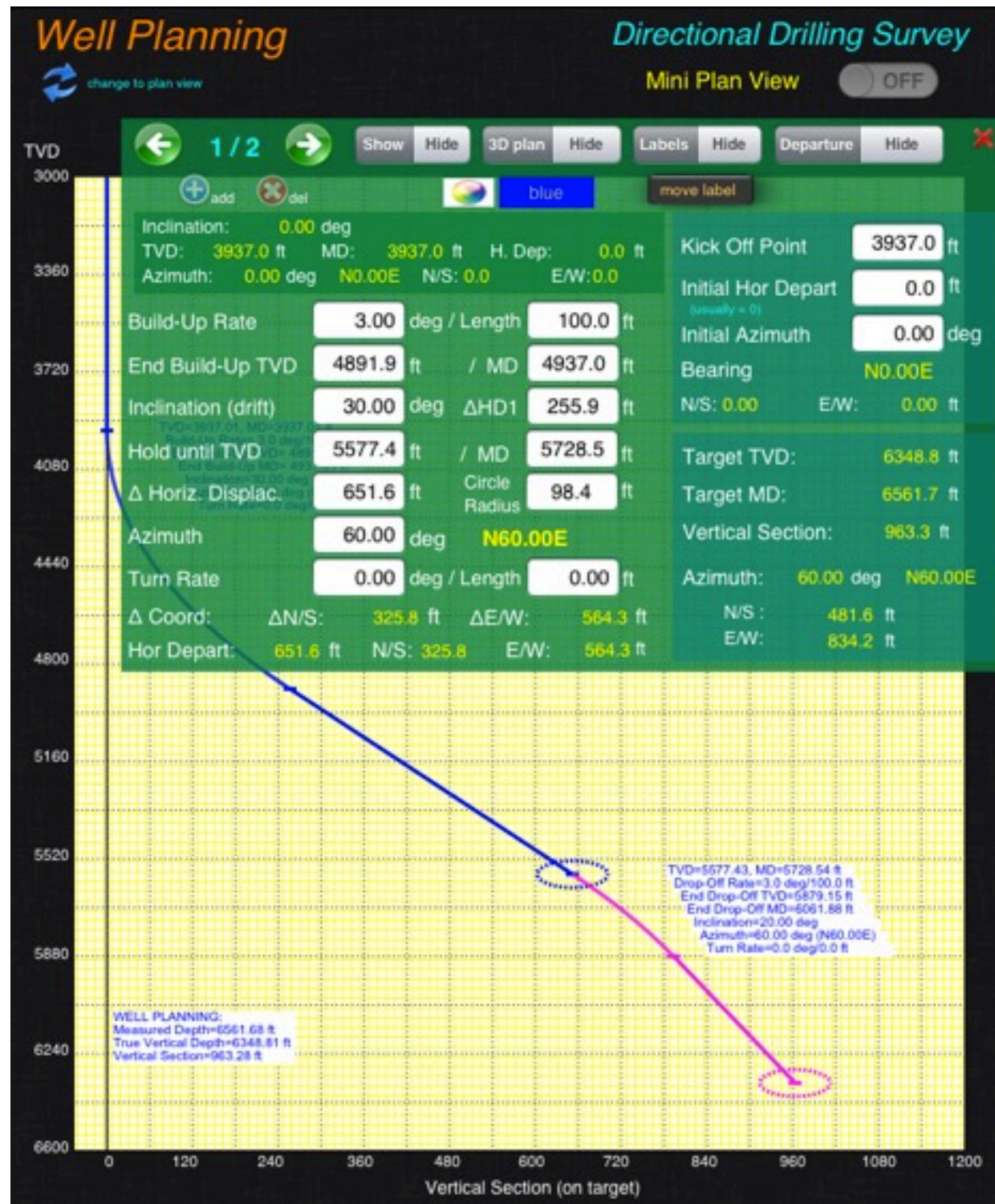
ot (ft) **Email** Print Save X-Y-

With the Multiple Sections Feature is possible to build any type of well

Use 01 section only for Wells Type SLANT and Horizontal Well (inclination = 90 degree)



Use 02 sections for Wells Type S-Curve

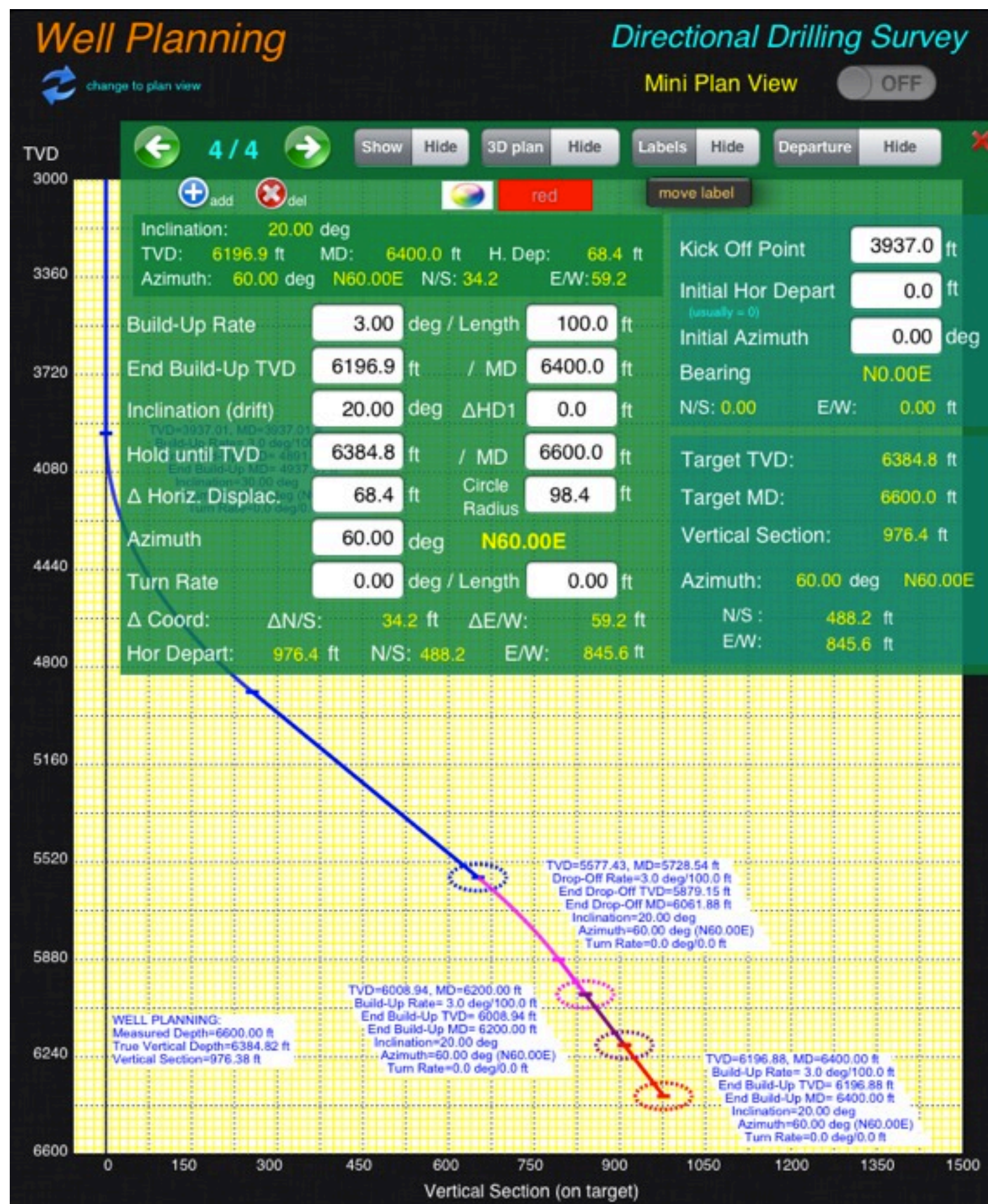


Use any section for Horizontal Type



With the Multiple Sections Feature is possible to build any type of well.

This app is limited to 10 sections



It is possible to set different azimuths and different turn rates for each section.

Exemple with 04 sections:

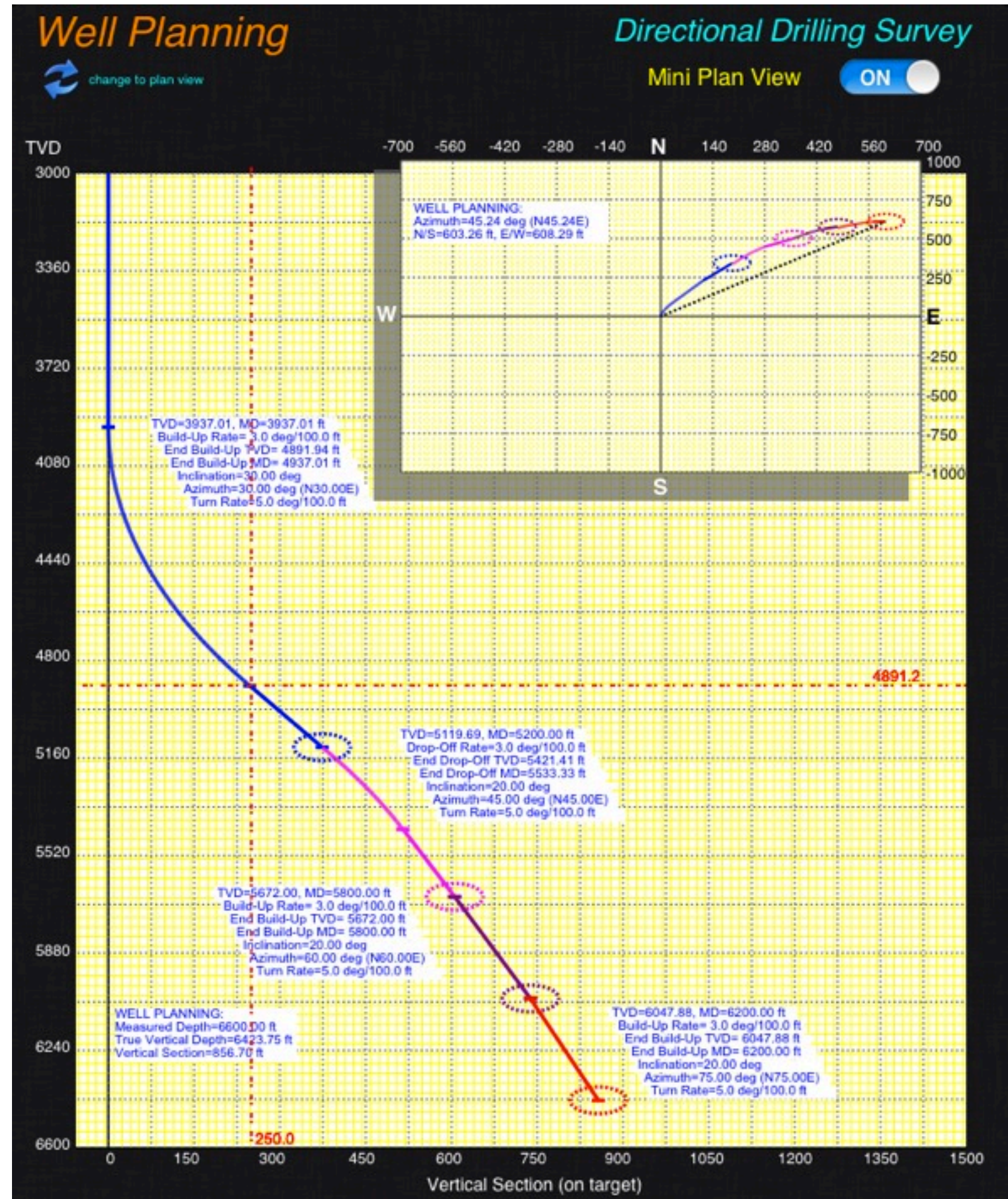
Initial Azimuth = 0 deg

Azimuth 1 = 30 deg @ 3 deg / 100 ft

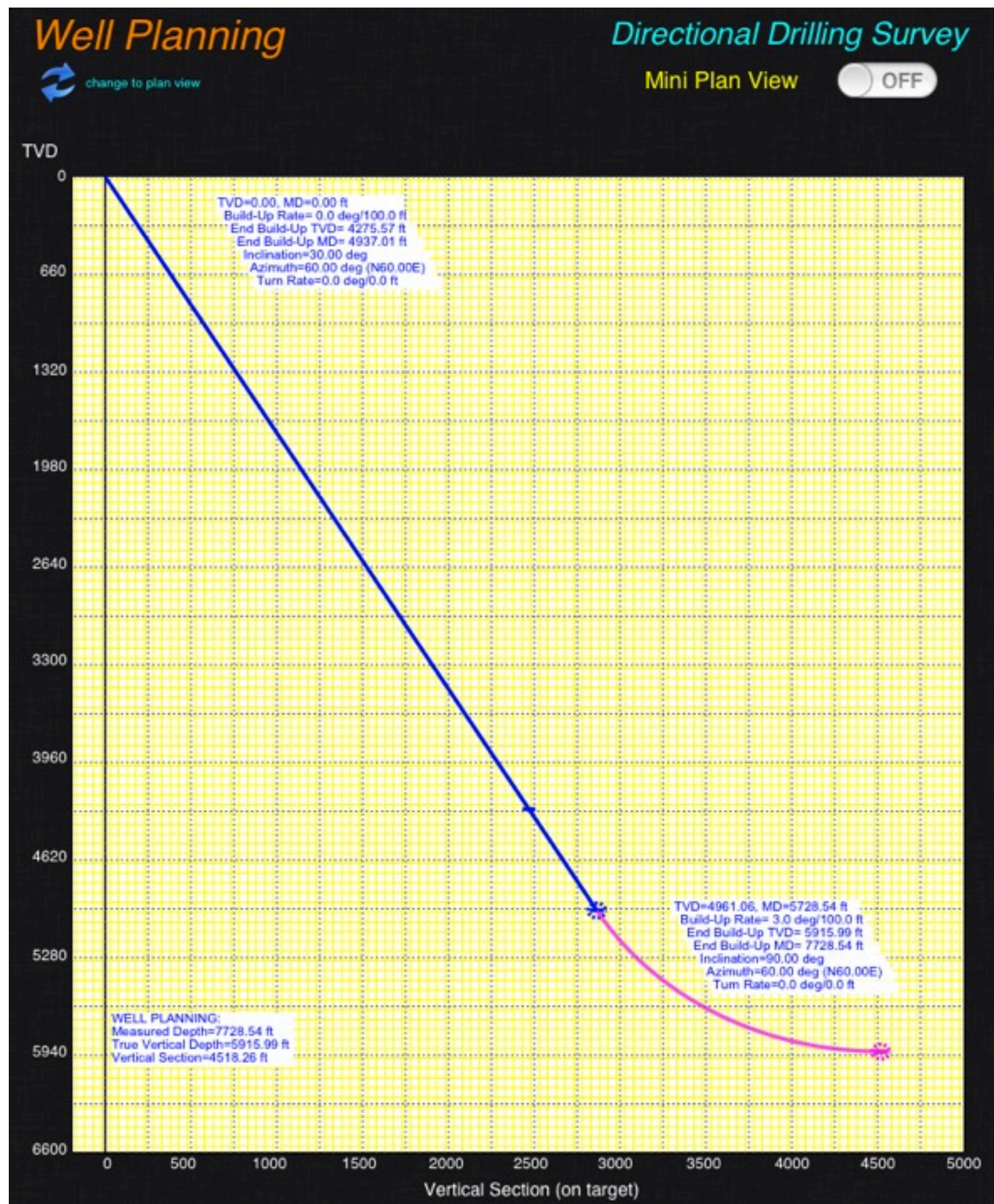
Azimuth 2 = 45 deg @ 4 deg / 100 ft

Azimuth 3 = 60 deg @ 5 deg / 100 ft

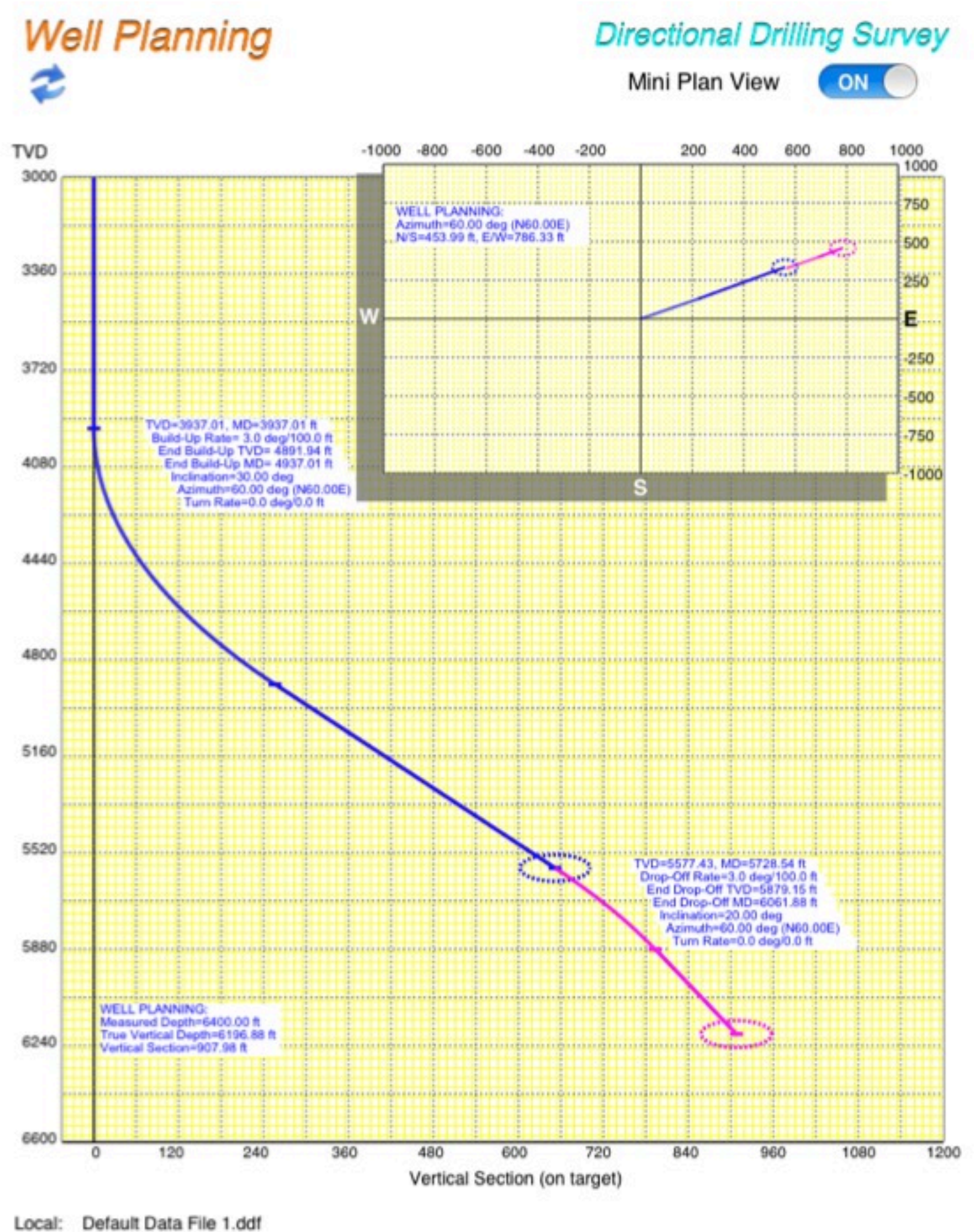
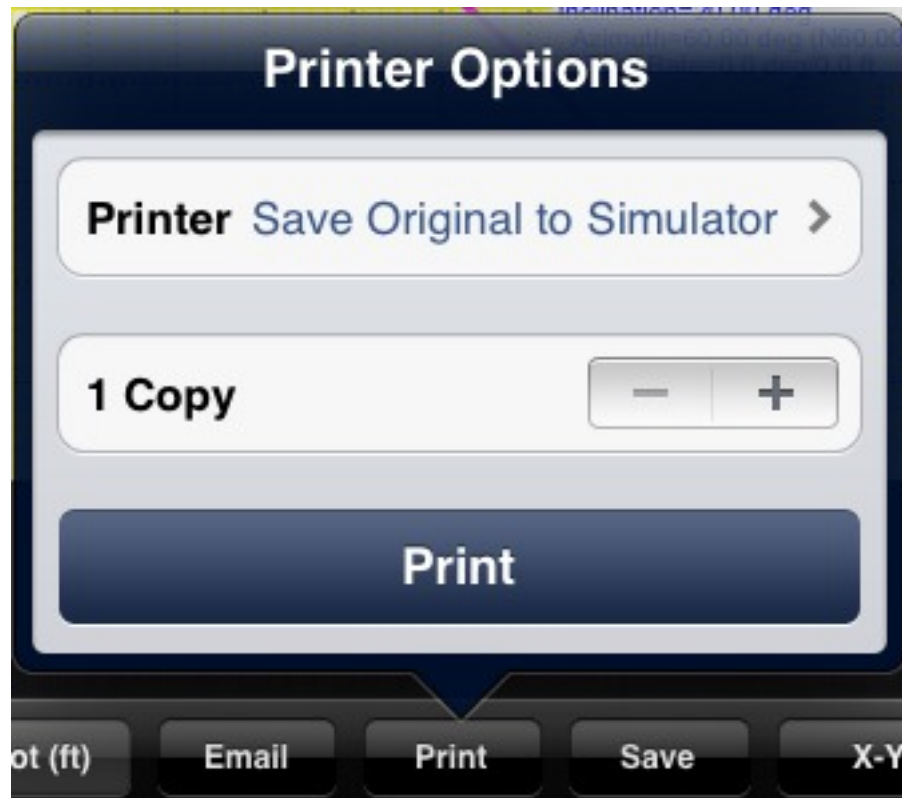
Azimuth 4 = 75 deg @ 6 deg / 100 ft



It is possible to set
angle rate = 0 deg / 100 ft



I- Use the 'Print' button to print a screenshot with background color white.



1. [Single Well Survey](#)
2. [Calculation Methods](#)
3. [iPad on Portrait Position](#)
4. [iPad on Portrait Position - X-Y-Z View](#)
5. [iPad on Landscape Position](#)
6. [iPad on Landscape Position - X-Y-Z View](#)
7. [Graph Options](#)
8. [Editing Tie-In Data](#)
9. [Adding Survey Data Item](#)
10. [Survey Data Table](#)
11. [Editing Survey Data Item](#)
12. [Removing Survey Data Item](#)
13. [Inserting Survey Data Item](#)
14. [Recalculating Survey Data Table](#)
15. [Emailing Survey Data Table](#)
16. [Exporting Survey Data Table by Email](#)
17. [Import / Export Survey Data Table using Mac version](#)
18. [Printing Survey Data](#)

Before use this feature, selected a data file and set the well planning.

- Define the Tie-In. Use the Tie-In button to set or edit the Tie-In data.
(Term used in this app as the first survey data)

- Use the Data View to Add, Insert, Edit, Save and Remove Survey Data.

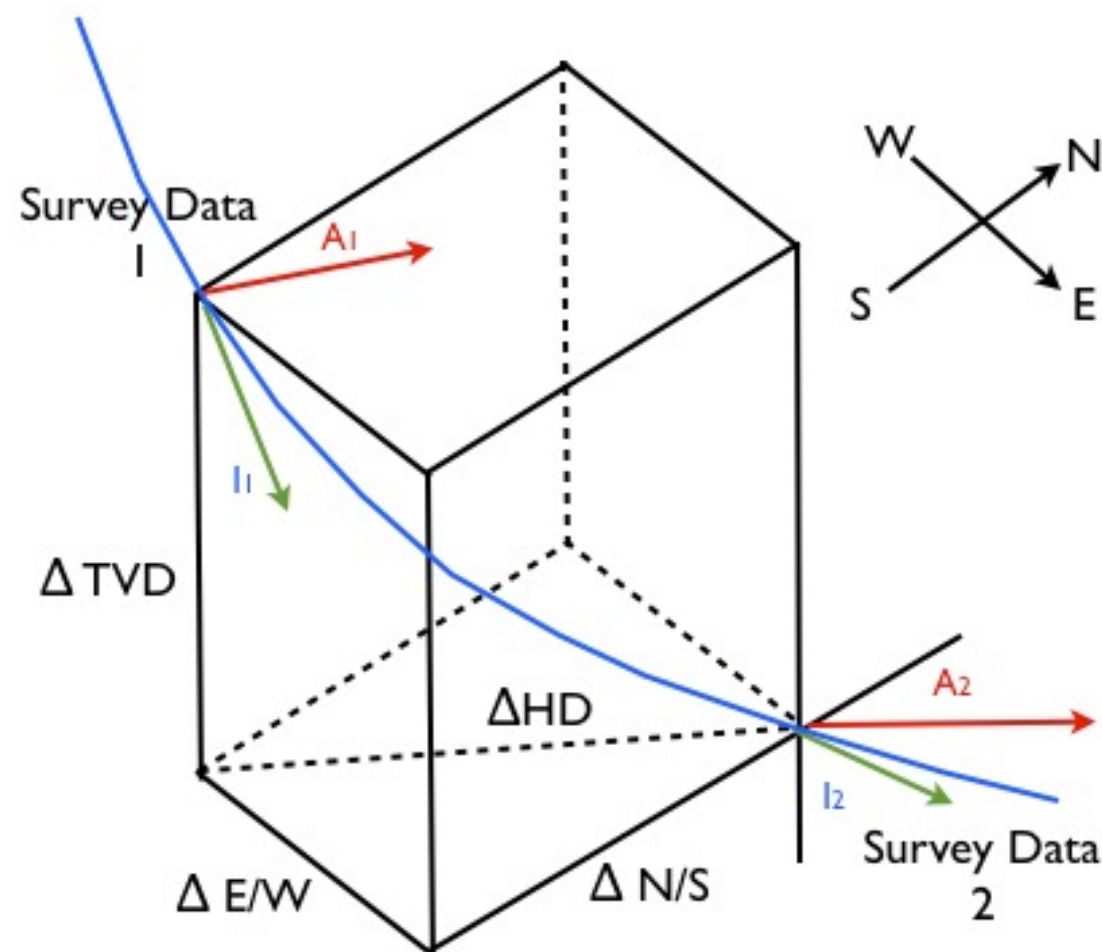
The survey data are plotted in Vertical Section when the iPad is on Portrait Position and Plan View on Landscape position.

- Use the Range button to define the range to the graph.

- Use the Recalc button to select a method to recalculate the survey table.

- Tangential
- Balanced Tangential
- Minimum Curvature
- Radius of Curvature
- Angle Averaging

- Use the Table button to show the survey table.



ΔHD = Horizontal Displacement
between stations

1) TANGENTIAL:

$$\begin{aligned}\Delta N/S &= \Delta MD \times \sin(I_2) \times \cos(A_2) \\ \Delta E/W &= \Delta MD \times \sin(I_2) \times \sin(A_2) \\ \Delta TVD &= \Delta MD \times \cos(I_2)\end{aligned}$$

DOG LEG SEVERITY (degree/100ft)

$$DLS = 100 \div \{MD \times [\sin(I_1) \times \sin(I_2) \times (\sin(A_1) \times \sin(A_2) + \cos(A_1) \times \cos(A_2)) + (\cos I_1 \times \cos I_2)]\}$$

2) BALANCED TANGENTIAL:

$$\begin{aligned}\Delta N/S &= \Delta MD/2 \times [\sin(I_1) \times \cos(A_1) + \sin(I_2) \times \cos(A_2)] \\ \Delta E/W &= \Delta MD/2 \times [\sin(I_1) \times \sin(A_1) + \sin(I_2) \times \sin(A_2)] \\ \Delta TVD &= \Delta MD/2 \times [\cos(I_1) + \cos(I_2)]\end{aligned}$$

3) MINIMUM CURVATURE:

$$\begin{aligned}\Delta N/S &= \Delta MD/2 \times [\sin(I_1) \times \cos(A_1) + \sin(I_2) \times \cos(A_2)] \times RF \\ \Delta E/W &= \Delta MD/2 \times [\sin(I_1) \times \sin(A_1) + \sin(I_2) \times \sin(A_2)] \times RF \\ \Delta TVD &= \Delta MD/2 \times [\cos(I_1) + \cos(I_2)] \times RF\end{aligned}$$

$$\begin{aligned}B &= \arccos [\cos(I_2 - I_1) - (\sin(I_1) \times \sin(I_2) \times (1 - \cos(A_2 - A_1)))] \text{ (in radians)} \\ RF &= 2/B \times \tan(B/2)\end{aligned}$$

4) RADIUS OF CURVATURE:

$$\begin{aligned}\Delta N/S &= [\Delta MD \times (\cos(I_1) - \cos(I_2)) \times (\sin(A_2) - \sin(A_1))] / [(I_2 - I_1) \times (A_2 - A_1)] \\ \Delta E/W &= [\Delta MD \times (\cos(I_1) - \cos(I_2)) \times (\cos(A_1) - \cos(A_2))] / [(I_2 - I_1) \times (A_2 - A_1)] \\ \Delta TVD &= \Delta MD/2 \times [\sin(I_2) - \sin(I_1)] / (I_2 - I_1)\end{aligned}$$

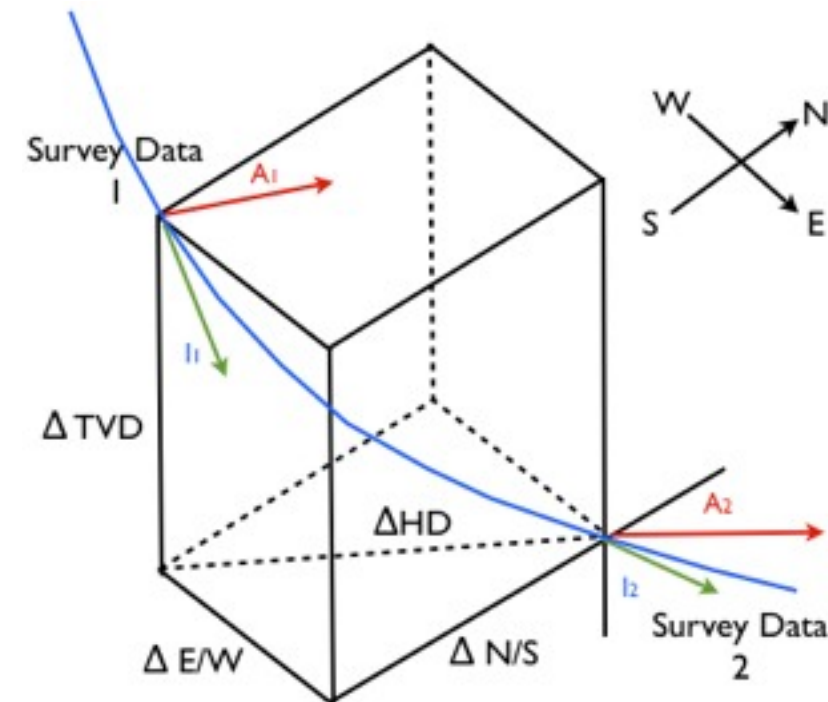
Angles in radians. $A(\text{deg}) \times \pi / 180 \Rightarrow \text{radian}$

DOG LEG SEVERITY (degree/100ft):

$$DLS = \{\arccos [\cos(I_1) \times \cos(I_2) + (\sin(I_1) \times \sin(I_2) \times \cos(A_2 - A_1))]\} \times (100 \div MD)$$

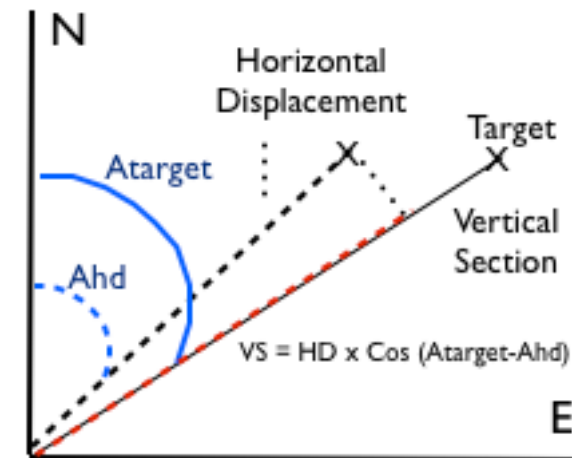
5) ANGLE AVERAGING:

$$\begin{aligned}\Delta N/S &= \Delta MD \times \sin((I_1 + I_2)/2) \times \cos((A_1 + A_2)/2) \\ \Delta E/W &= \Delta MD \times \sin((I_1 + I_2)/2) \times \sin((A_1 + A_2)/2) \\ \Delta TVD &= \Delta MD \times \cos((I_1 + I_2)/2)\end{aligned}$$



For All Methods:

$$\Delta HD = \text{Square Root } [(\Delta N/S)^2 + (\Delta E/W)^2]$$



$$\begin{aligned}HD &= \text{Square Root } [(N/S)^2 + (E/W)^2] \\ \text{Vertical Section} &= HD \times \cos(A_{\text{target}} - A_{\text{hd}})\end{aligned}$$

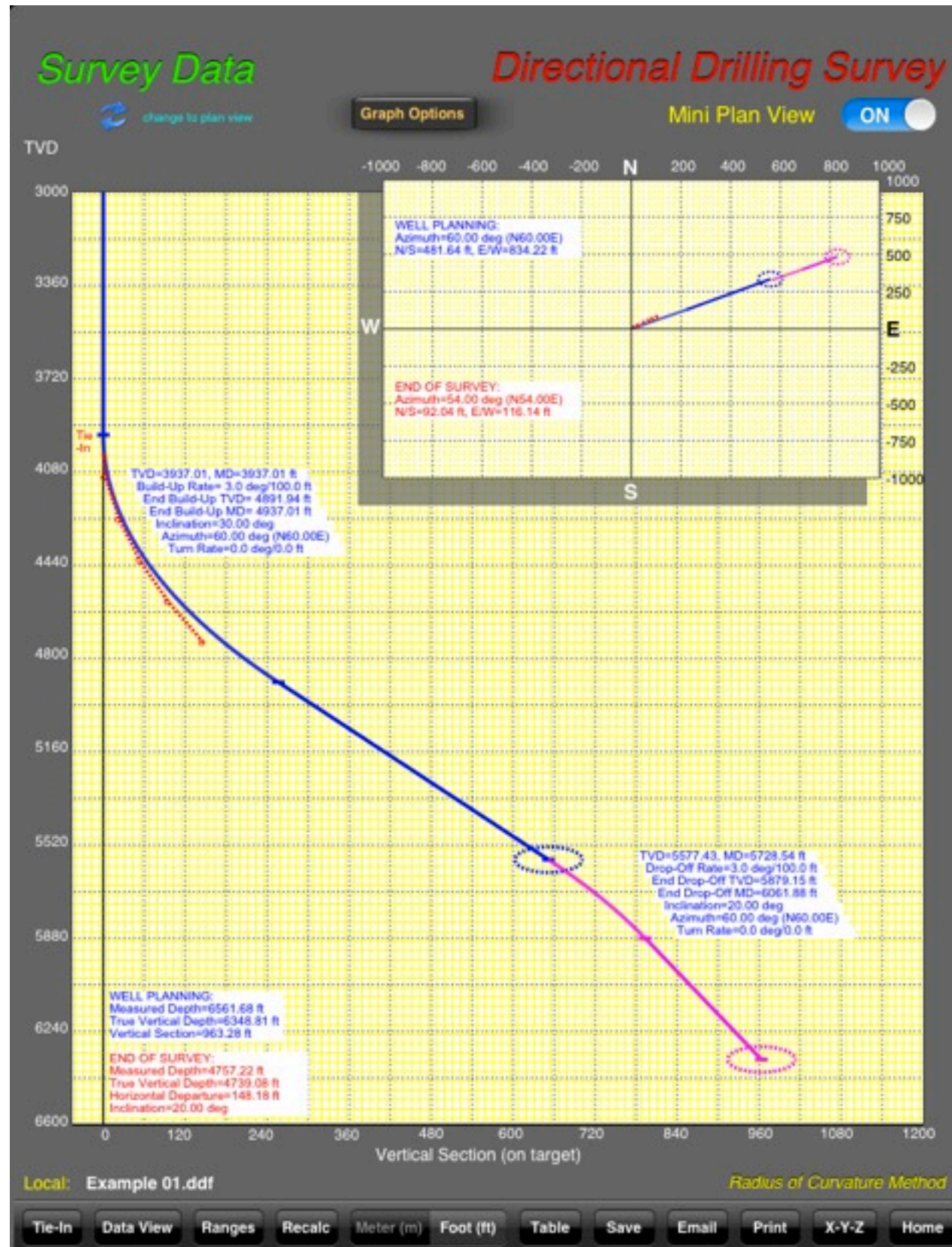
Dog Leg Severity is calculated on two methods only:

- Tangential
- Radius of Curvature

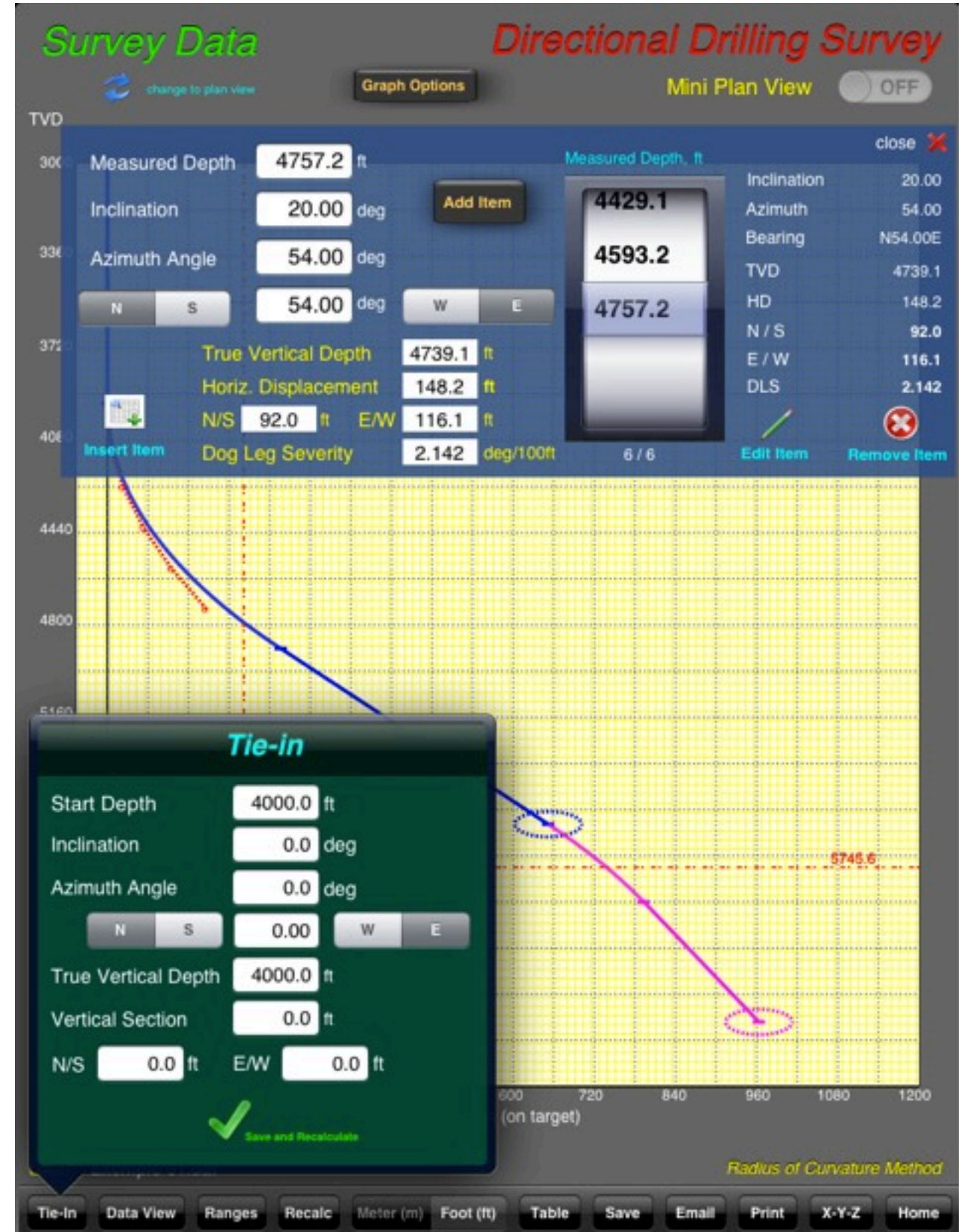
Equivalent Terms used in this app:

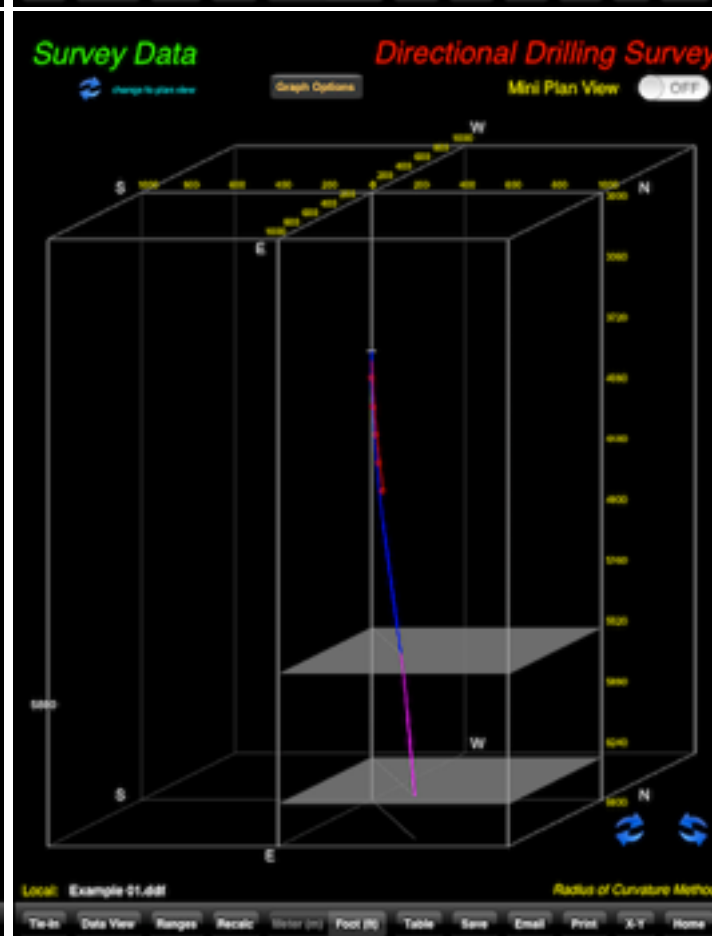
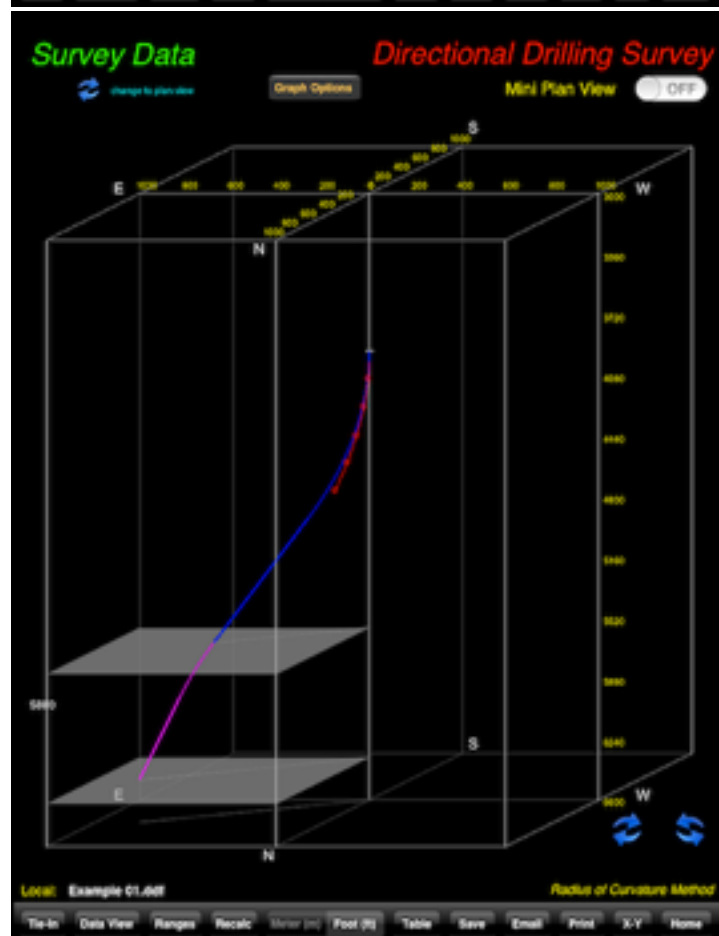
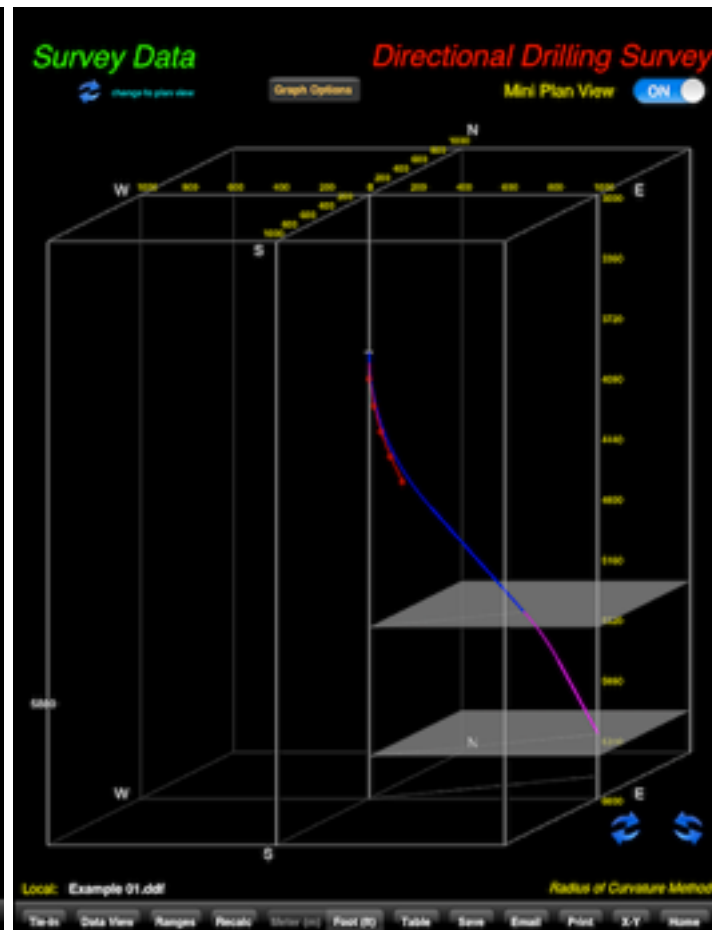
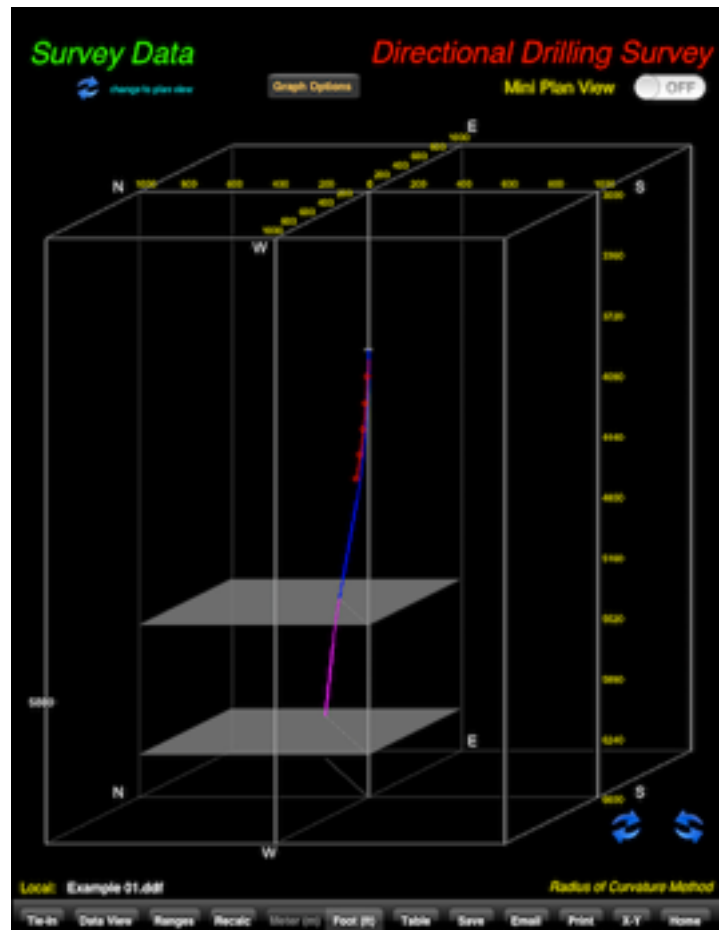
- Horizontal Displacement
- Horizontal Departure
- Closure Distance

Show the Vertical View and Mini Plan View (optional)



Important: Use this position to edit parameters

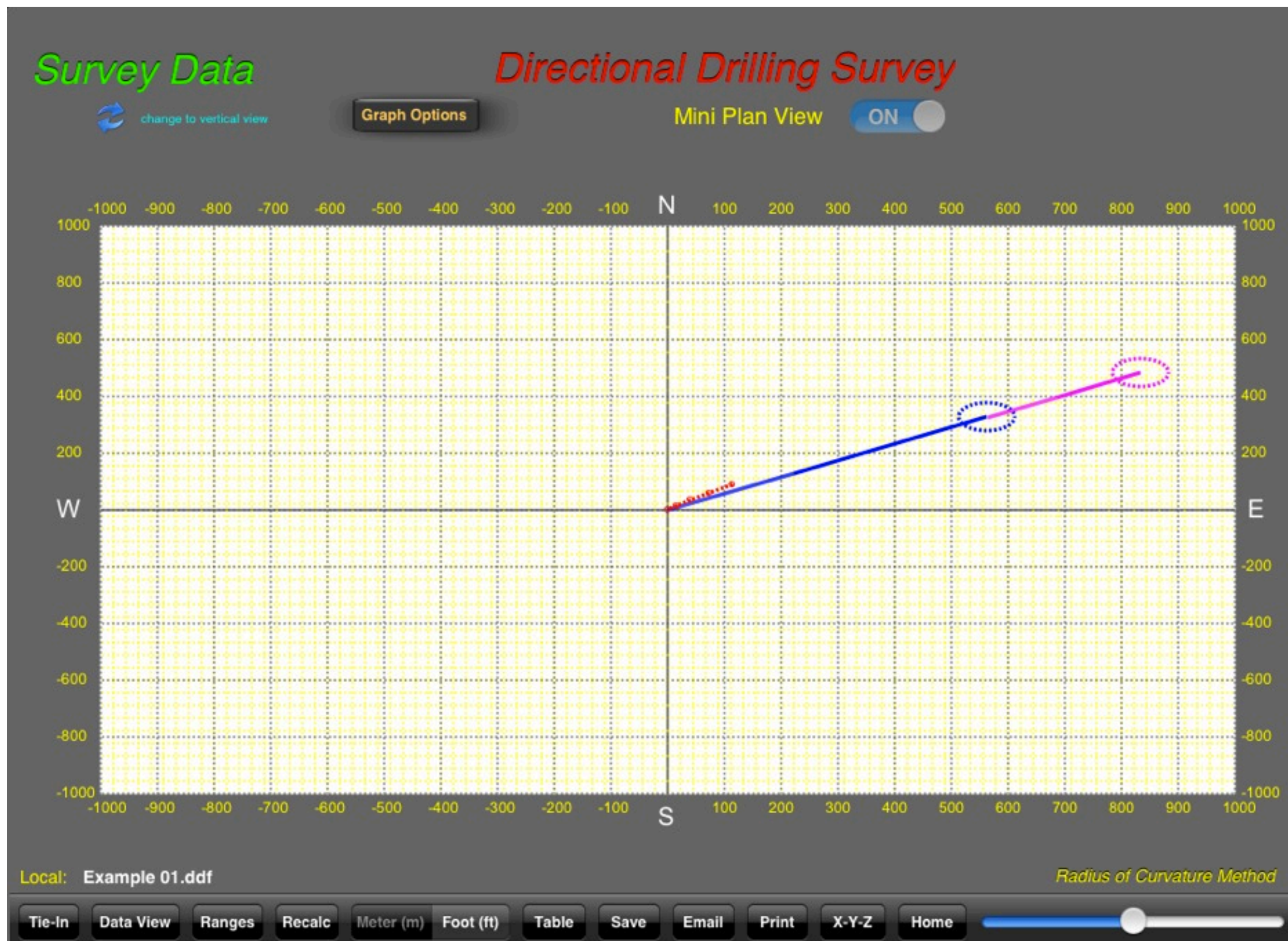


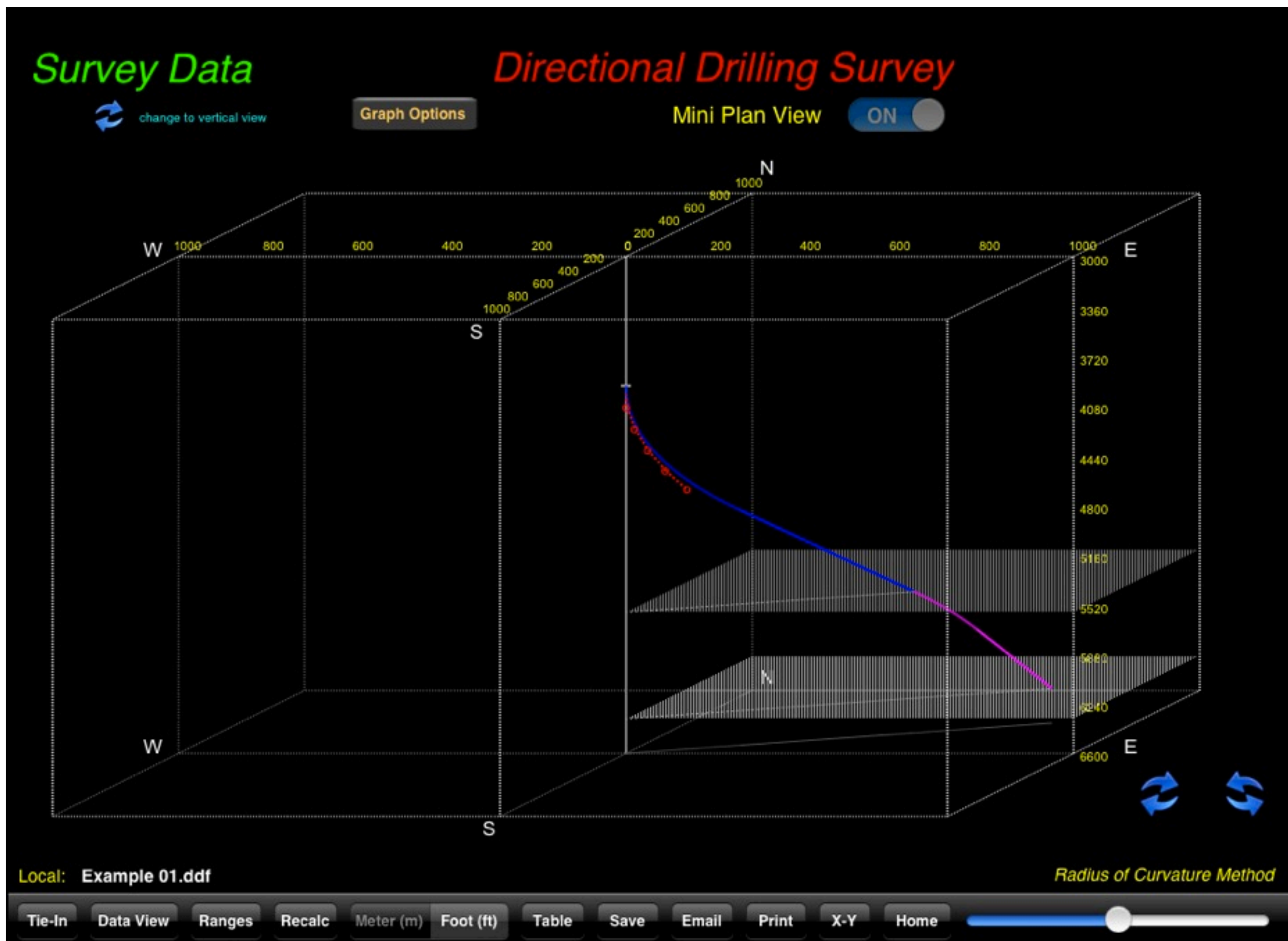


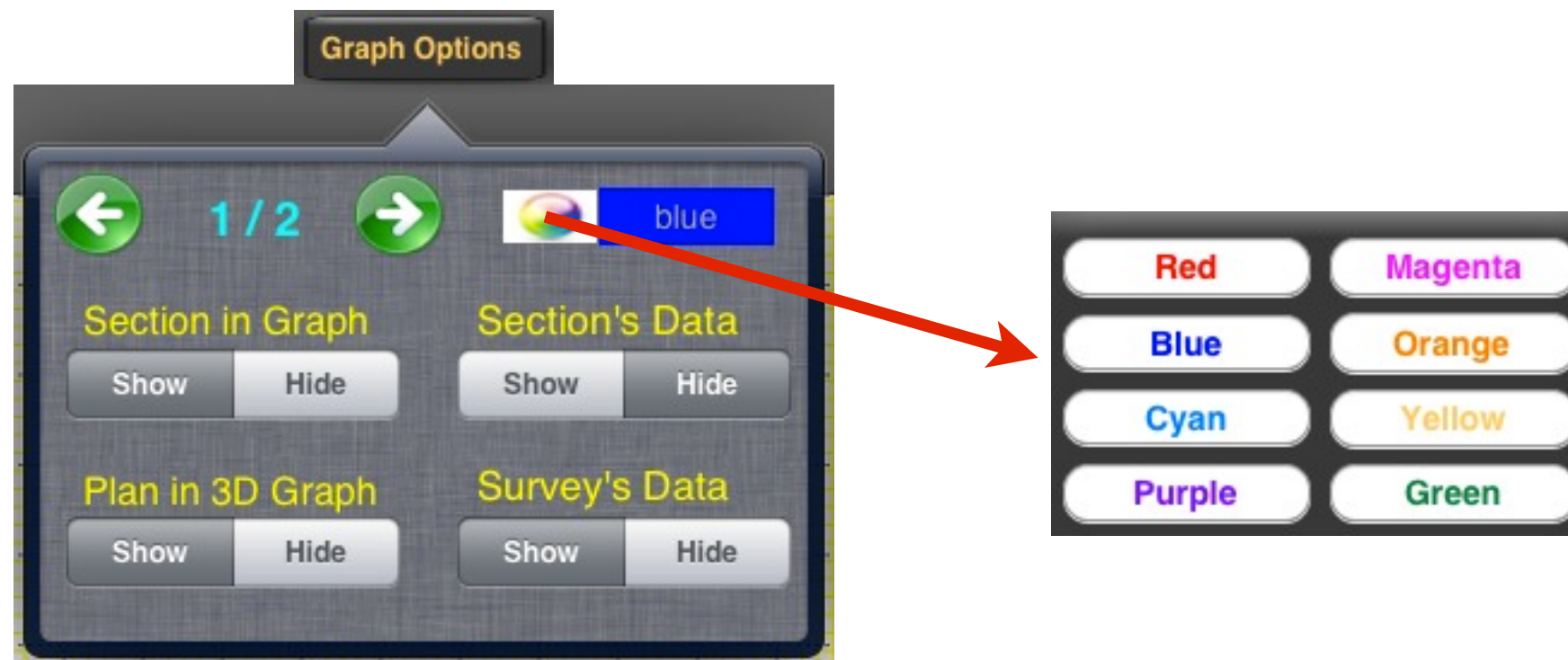
Rotation buttons



Show the Plan View







The screenshot shows the 'Graph Ranges' menu. At the top, there is a 'Save' button. Below it, there are two sections:

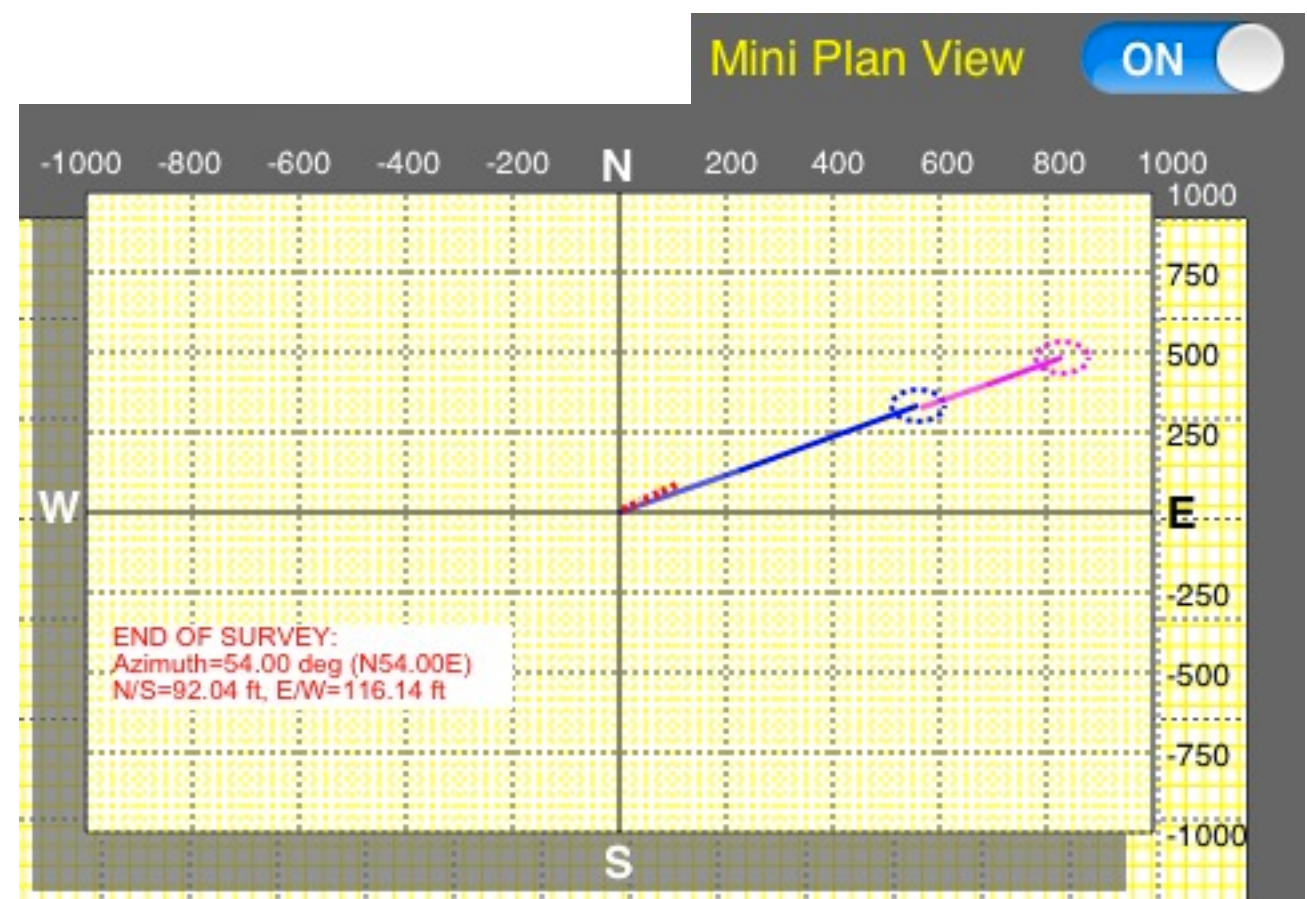
Vertical Section View

	Min	Max	
Vertical Depth	3000	6600	ft
Vertical Section	0	1200	ft

Plan View (Maximum Values)

N / S	E / W	
1000	1000	ft

At the bottom, there are buttons for 'Tie-In', 'Data View', 'Ranges', 'Recalc', and a unit selector between 'Meter (m)' and 'Foot'.



Term used in this app as the first survey data.

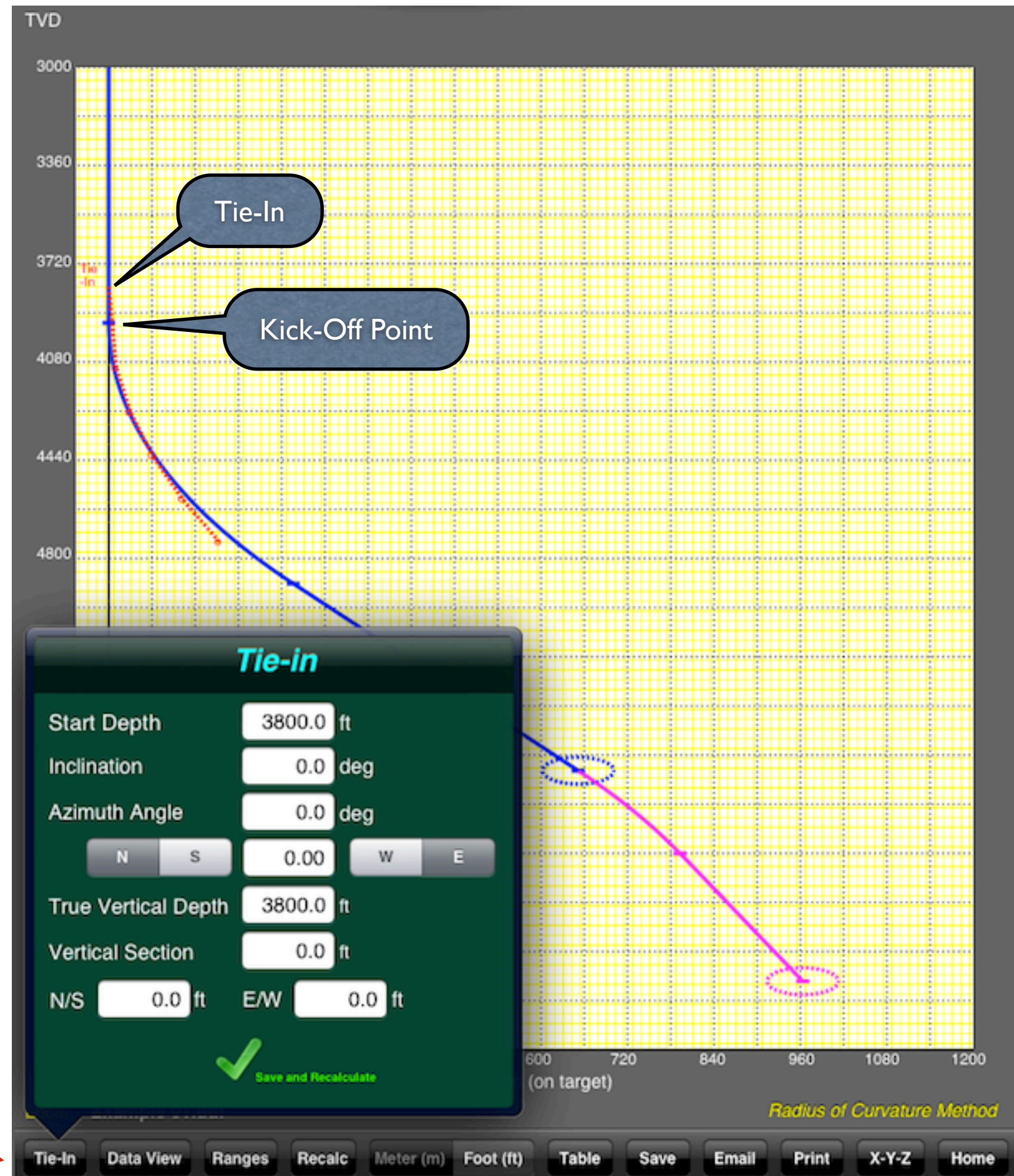
Use the Tie-In button to set or edit the Tie-In data.

Attention:

Tap on “Save and recalculate” button to set values.



or Tap on the “Tie-In” button to Cancel.



Use the Data View button to edit the Survey Data.

- The first data is the Tie-In data. Use the Tie-In button to edit it and Set MD=3800 ft and TVD=3800 ft.
- Use the textbox to enter survey data.
- After edit the Azimuth, tap “DONE” key to show the Bearing, for example: Azimuth = 60 => Bearing = N 60 E

- Enter MD, Inclination and Azimuth in each textbox and tap the “**Add Item**” button.

for example, enter the follow survey data:

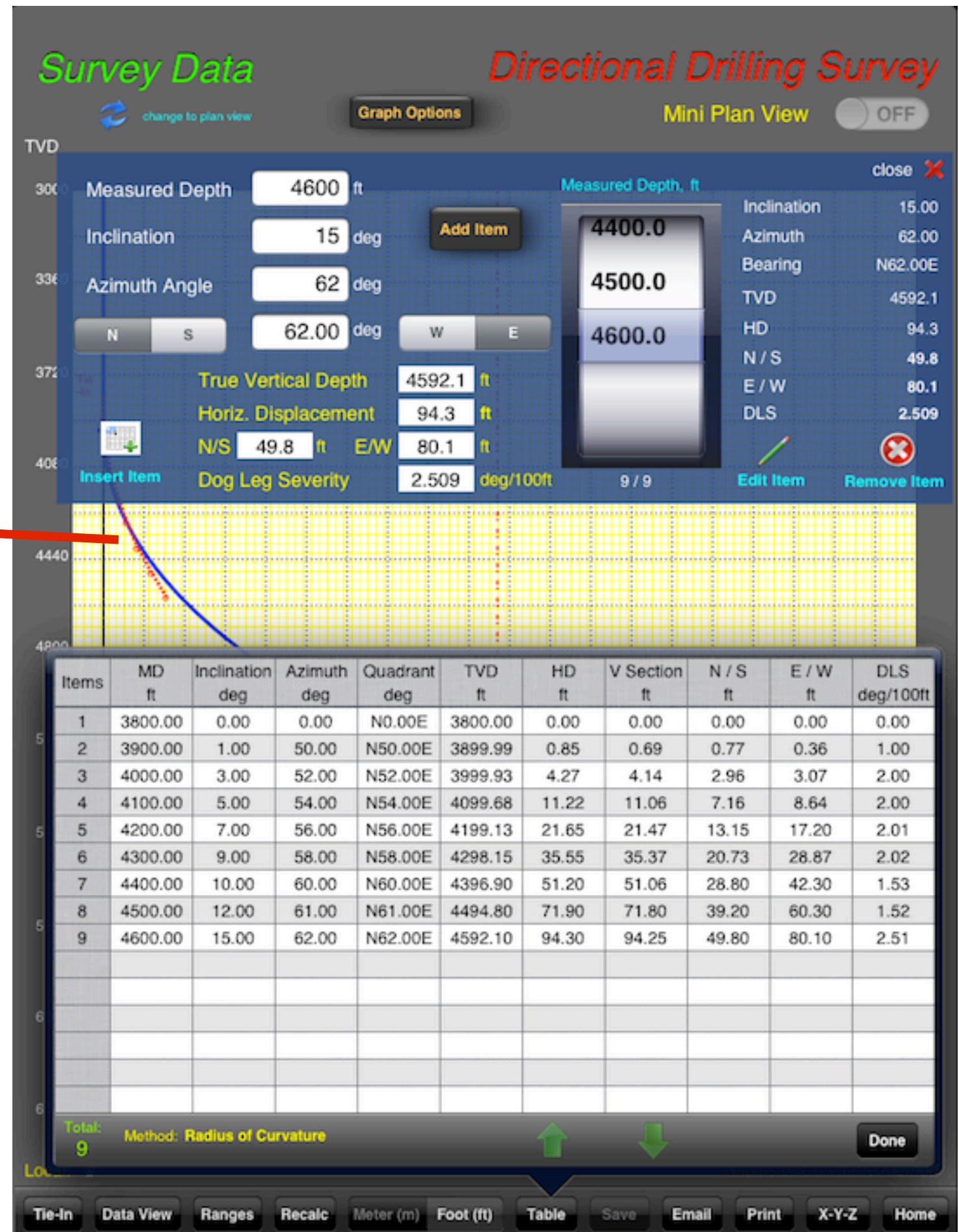
Items	MD ft	Inclination deg	Azimuth deg
1	3800.00	0.00	0.00
2	3900.00	1.00	50.00
3	4000.00	3.00	52.00
4	4100.00	5.00	54.00
5	4200.00	7.00	56.00
6	4300.00	9.00	58.00
7	4400.00	10.00	60.00
8	4500.00	12.00	61.00
9	4600.00	15.00	62.00

Attention:

Use the ‘**Save**’ button on toolbar to save to the data file after editing.

Attention:

Tap on “Done” key for calculations



1- On Data View, roll up/down the wheel and stop on item selected and Tap on 'Edit Item' button.

- The textbox are filled with items of survey.

- The 'Add Item' button change to 'Save Item'.

Measured Depth: 4400.0 ft

Inclination: 10.00 deg

Azimuth Angle: 60.00 deg

True Vertical Depth: 4396.9 ft

Horiz. Displacement: 51.2 ft

N/S: 28.8 ft E/W: 42.3 ft

Dog Leg Severity: 1.528 deg/100ft

Measured Depth, ft: 4200.0, 4300.0, 4400.0, 4500.0, 4600.0

Inclination: 10.00

Azimuth: 60.00

Bearing: N60.00E

TVD: 4396.9

HD: 51.2

N / S: 28.8

E / W: 42.3

DLS: 1.528

Buttons: Insert Item, Save Item, Edit Item, Remove Item

2- Edit the parameters, for example change inclination from 10 to 11 deg, and Tap on 'Save Item' button.

- Tap on "Done" key after edit each parameter to calculate survey.

- Tap on 'Save Item'.

Measured Depth: 4400.0 ft

Inclination: 11 deg

Azimuth Angle: 60.00 deg

True Vertical Depth: 4396.6 ft

Horiz. Displacement: 52.9 ft

N/S: 29.7 ft E/W: 43.8 ft

Dog Leg Severity: 2.030 deg/100ft

Measured Depth, ft: 4200.0, 4300.0, 4400.0, 4500.0, 4600.0

Inclination: 11.00

Azimuth: 60.00

Bearing: N60.00E

TVD: 4396.6

HD: 52.9

N / S: 29.7

E / W: 43.8

DLS: 2.030

Buttons: Insert Item, Save Item, Edit Item, Remove Item

3- The 'Save Item' button return to 'Add Item'.

- The values are updated.

- Roll up/down the wheel and repeat for other item.

Attention:

Use the 'Save' button on toolbar to save to the data file after editing.

Measured Depth: 4400.0 ft

Inclination: 11 deg

Azimuth Angle: 60.00 deg

True Vertical Depth: 4396.6 ft

Horiz. Displacement: 52.9 ft

N/S: 29.7 ft E/W: 43.8 ft

Dog Leg Severity: 2.030 deg/100ft

Measured Depth, ft: 4200.0, 4300.0, 4400.0, 4500.0, 4600.0

Inclination: 11.00

Azimuth: 60.00

Bearing: N60.00E

TVD: 4396.6

HD: 52.9

N / S: 29.7

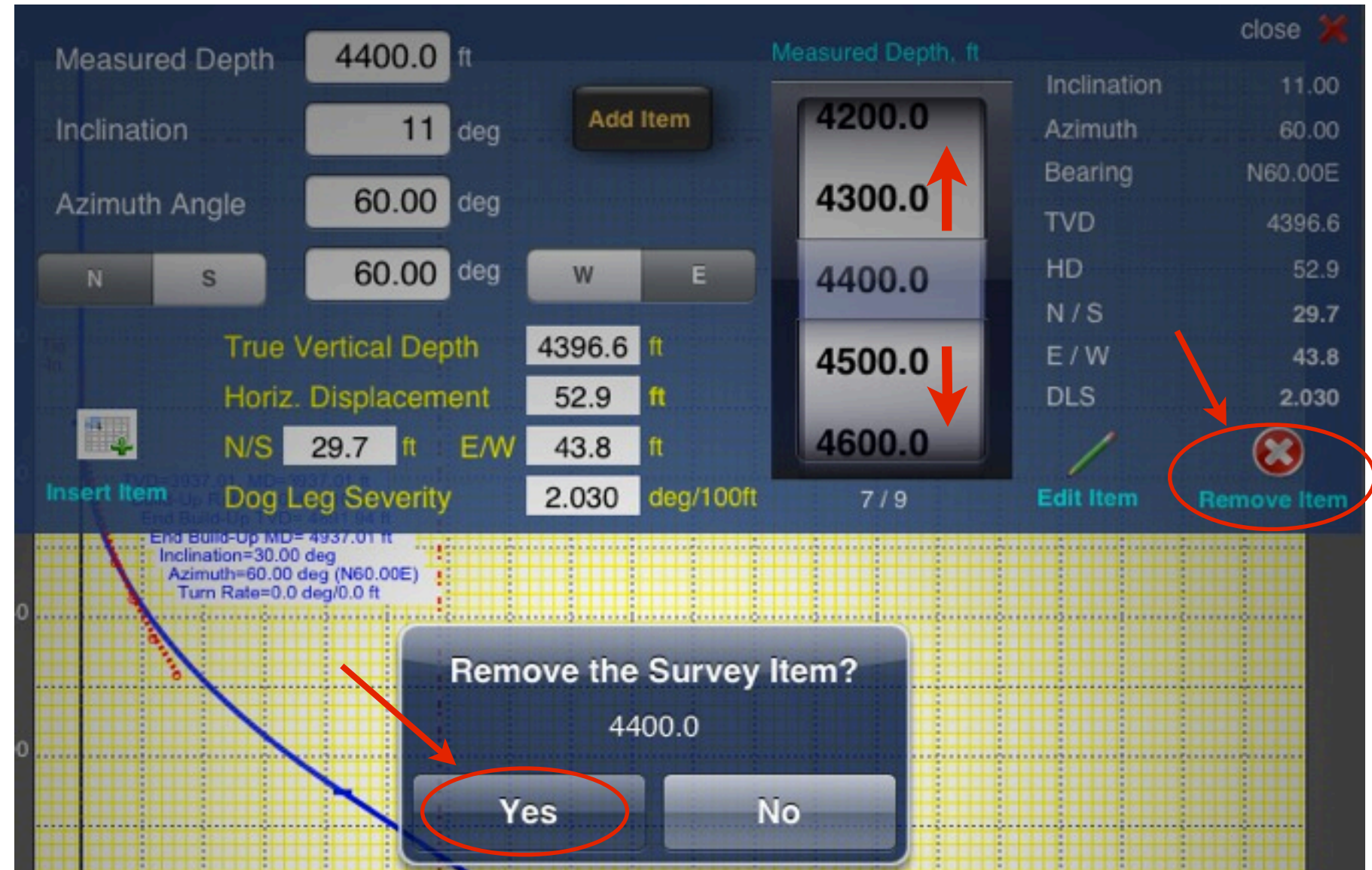
E / W: 43.8

DLS: 2.030

Buttons: Insert Item, Add Item, Edit Item, Remove Item

1- On Data View, roll up/down the wheel and stop on item selected and Tap on 'Remove Item' button.

- Tap YES button on popup.



2- The wheel go to the next item.

- Roll up/down the wheel and repeat for other item.

Attention:

Use the '**Save**' button on toolbar to save to the data file after editing.



1- On Data View, roll up/down the wheel and stop on item for insert before.

- Enter parameters of survey.

- Tap on 'Insert Item'.

Measured Depth 4250 ft

Inclination 8.3 deg

Azimuth Angle 57.2 deg

N S W E

True Vertical Depth 4248.7 ft

Horiz. Displacement 28.3 ft

N/S 16.8 ft E/W 22.8 ft

Dog Leg Severity 2.619 deg/100ft

Measured Depth, ft

4100.0

4200.0

4300.0

4500.0

4600.0

6 / 8

Inclination 9.00

Azimuth 58.00

Bearing N58.00E

TVD 4298.1

HD 35.5

N / S 20.7

E / W 28.9

DLS 2.019

Insert Item

Edit Item

Remove Item

2- The wheel is updated and show item inserted.

- Roll up/down the wheel and repeat for other item.

Measured Depth 4250 ft

Inclination 8.3 deg

Azimuth Angle 57.2 deg

N S W E

True Vertical Depth 4248.7 ft

Horiz. Displacement 28.3 ft

N/S 16.8 ft E/W 22.8 ft

Dog Leg Severity 2.619 deg/100ft

Measured Depth, ft

4100.0

4200.0

4250.0

4300.0

4500.0

6 / 9

Inclination 8.30

Azimuth 57.20

Bearing N57.20E

TVD 4248.7

HD 28.3

N / S 16.8

E / W 22.8

DLS 2.619

Insert Item

Edit Item

Remove Item

Attention:

Use the **'Save'** button on toolbar to save to the data file after editing.

I- Use the 'Recalc' button to select the method to calculate the survey data table:

Select the Method to recalculate survey data

Tangential

Balanced Tangential

Minimum Curvature

Radius of Curvature

Angle Averaging

Ranges Recalc Meter (m)

Items	MD ft	Inclination deg	Azimuth deg	Quadrant deg	TVD ft	HD ft	V Section ft	N / S ft	E / W ft	DLS deg/100ft
1	3800.00	0.00	0.00	N0.00E	3800.00	0.00	0.00	0.00	0.00	0.00
2	3900.00	1.00	50.00	N50.00E	3899.98	1.75	1.72	1.12	1.34	1.00
3	4000.00	3.00	52.00	N52.00E	3999.85	6.98	6.90	4.34	5.46	1.00
4	4100.00	5.00	54.00	N54.00E	4099.47	15.69	15.57	9.47	12.51	1.00
5	4200.00	7.00	56.00	N56.00E	4198.72	27.87	27.73	16.28	22.62	1.00
6	4250.00	8.30	57.20	N57.20E	4248.20	35.08	34.94	20.19	28.68	2.00
7	4300.00	9.00	58.00	N58.00E	4297.58	42.89	42.75	24.34	35.32	2.00
8	4500.00	12.00	61.00	N61.00E	4493.21	84.37	84.33	44.50	71.68	0.50
9	4600.00	15.00	62.00	N62.00E	4589.80	110.21	110.19	56.65	94.54	1.00
Total: 9 Method: Tangential										

Items	MD ft	Inclination deg	Azimuth deg	Quadrant deg	TVD ft	HD ft	V Section ft	N / S ft	E / W ft	DLS deg/100ft
1	3800.00	0.00	0.00	N0.00E	3800.00	0.00	0.00	0.00	0.00	0.00
2	3900.00	1.00	50.00	N50.00E	3899.99	0.85	0.69	0.77	0.36	1.00
3	4000.00	3.00	52.00	N52.00E	3999.93	4.27	4.14	2.96	3.07	2.00
4	4100.00	5.00	54.00	N54.00E	4099.68	11.22	11.06	7.16	8.64	2.00
5	4200.00	7.00	56.00	N56.00E	4199.13	21.65	21.47	13.15	17.20	2.01
6	4250.00	8.30	57.20	N57.20E	4248.68	28.30	28.12	16.82	22.76	2.62
7	4300.00	9.00	58.00	N58.00E	4298.11	35.80	35.63	20.85	29.11	1.42
8	4500.00	12.00	61.00	N61.00E	4494.74	72.17	72.07	39.34	60.50	1.52
9	4600.00	15.00	62.00	N62.00E	4591.97	95.46	95.40	50.48	81.02	3.01
Total: 9 Method: Radius of Curvature										

Attention:

- It's recommended to recalculate after editing survey data items.
- Use the '**Save**' button on toolbar to save to the data file after editing.

I- Use the 'Email' button to send:

- 'Well Planning'
- 'Survey Data Table'
- Survey CSV Text Format
- Screenshot



Data File: *Example 01.ddf*

WELL PLANNING:

Kick Off Point = 3937.01 ft
 Initial Departure = 0.00 ft
 Initial Azimuth = 0.00 degree (N0.00E)
 Initial N/S = 0.00 ft
 Initial E/W = 0.00 ft

TOTAL SECTIONS: 2

SECTION: 1

Initial TVD=3937.01 ft
 Initial MD=3937.01 ft
 Build-Up Rate= 3.0 deg/100.0 ft
 End Build-Up TVD= 4891.94 ft
 End Build-Up MD= 4937.01 ft
 Inclination=30.00 deg
 Azimuth=60.00 deg (N60.00E)
 Turn Rate=0.0 deg/0.0 ft
 End TVD = 5577.43 ft
 End MD = 5728.54 ft
 Horizontal Departure = 651.64 ft
 N/S = 325.82 ft
 E/W = 564.34 ft
 Target Azimuth = 60.00 degree (N60.00E)
 Target N/S = 481.64 ft
 Target E/W = 834.22 ft

SECTION: 2

Initial TVD=5577.43 ft
 Initial MD=5728.54 ft
 Drop-Off Rate=3.0 deg/100.0 ft
 End Drop-Off TVD=5879.15 ft
 End Drop-Off MD=6061.88 ft
 Inclination=20.00 deg
 Azimuth=60.00 deg (N60.00E)
 Turn Rate=4.0 deg/100.0 ft
 End TVD = 6348.81 ft
 End MD = 6561.68 ft
 Horizontal Departure = 311.64 ft
 N/S = 155.82 ft
 E/W = 269.89 ft

TARGET:

Measured Depth = 6561.68 ft
 True Vertical Depth = 6348.81 ft
 Vertical Section = 963.28 ft
 Target Azimuth = 60.00 degree (N60.00E)
 Target N/S = 481.64 ft
 Target E/W = 834.22 ft

END OF SURVEY:

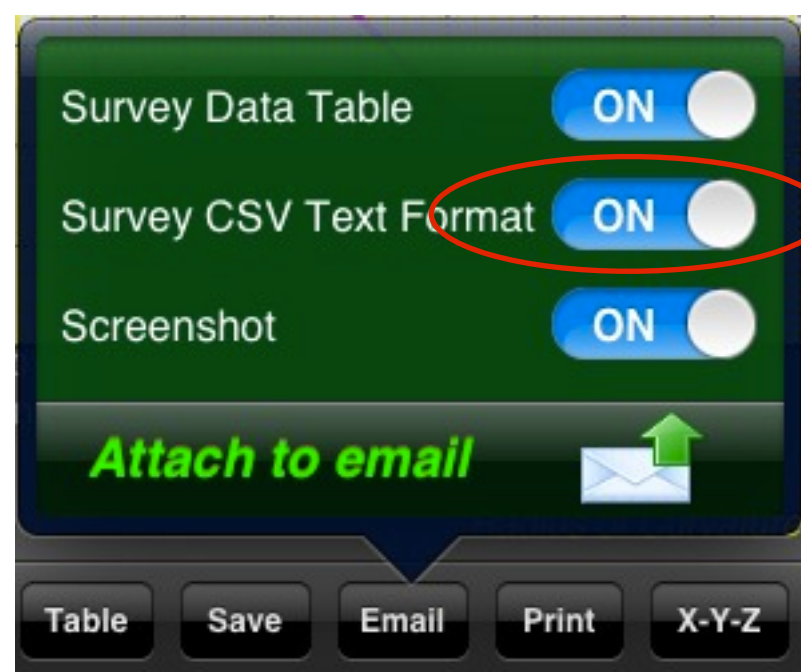
Tie-In Depth= 3800.00 ft
 Measured Depth = 4600.00 ft
 True Vertical Depth = 4591.40 ft
 Horizontal Departure = 97.80 ft
 Inclination = 15.00 degree
 Azimuth = 62.00 degree (N62.00E)
 N / S = 51.90 ft
 E / W = 82.90 ft

Nr.	M.Depth ft	Inclination degree	Azimuth degree	Bearing	TVD ft	HD ft	VSect ft	N/S ft	E/W ft	DLS deg/100ft
1	3800.00	0.00	0.00	N0.00E	3800.00	0.00	0.00	0.00	0.00	0.0000
2	3900.00	1.00	50.00	N50.00E	3899.99	0.85	0.69	0.77	0.36	1.0000
3	4000.00	3.00	52.00	N52.00E	3999.93	4.27	4.14	2.96	3.07	2.0009
4	4100.00	5.00	54.00	N54.00E	4099.68	11.22	11.06	7.16	8.64	2.0046
5	4200.00	7.00	56.00	N56.00E	4199.13	21.65	21.47	13.15	17.20	2.0106
6	4250.00	8.30	57.20	N57.20E	4248.68	28.30	28.12	16.82	22.76	2.6194
7	4300.00	9.00	58.00	N58.00E	4298.10	35.50	35.33	20.70	28.90	2.0190
8	4400.00	12.00	61.00	N61.00E	4396.30	54.70	54.58	30.40	45.40	2.5050
9	4600.00	15.00	62.00	N62.00E	4591.40	97.80	97.74	51.90	82.90	2.0180

I- Use the 'Email' button to send:

- 'Well Planning'
- 'Survey Data Table'
- Survey CSV Text Format
- Screenshot

Nr.	M.Depth ft	Inclination degree	Azimuth degree	Bearing	TVD ft	HD ft	VSect ft	N/S ft	E/W ft	DLS deg/100ft
1	3800.00	0.00	0.00	N0.00E	3800.00	0.00	0.00	0.00	0.00	0.0000
2	3900.00	1.00	50.00	N50.00E	3899.99	0.85	0.69	0.77	0.36	1.0000
3	4000.00	3.00	52.00	N52.00E	3999.93	4.27	4.14	2.96	3.07	2.0009
4	4100.00	5.00	54.00	N54.00E	4099.68	11.22	11.06	7.16	8.64	2.0046
5	4200.00	7.00	56.00	N56.00E	4199.13	21.65	21.47	13.15	17.20	2.0106
6	4250.00	8.30	57.20	N57.20E	4248.68	28.30	28.12	16.82	22.76	2.6194
7	4300.00	9.00	58.00	N58.00E	4298.10	35.50	35.33	20.70	28.90	2.0190
8	4400.00	12.00	61.00	N61.00E	4396.30	54.70	54.58	30.40	45.40	2.5050
9	4600.00	15.00	62.00	N62.00E	4591.40	97.80	97.74	51.90	82.90	2.0180



SURVEY DATA CSV TEXT FORMAT:

MD,Inclination,Azimuth,Quadrant,TVD,HD,V Section,N/S,E/W,DLS

```
3800.000000,0,0,N0.00E,3800.000000,0.000000,0.000000,0.000000,0.000000,0.000000
3900.000000,1,50,N50.00E,3899.994629,0.845214,0.692359,0.766025,0.357203,1.000001
3999.999756,3,52,N52.00E,3999.928467,4.265390,4.138990,2.962097,3.069126,2.000915
4100.000000,5,54,N54.00E,4099.679688,11.220672,11.061934,7.159717,8.639557,2.004558
4200.000000,7,56,N56.00E,4199.127441,21.654682,21.473984,13.154634,17.201187,2.010588
4250.000000,8,3,57.2,N57.20E,4248.681152,28.298033,28.118067,16.818521,22.757767,2.619417
4300.000000,9,58,N58.00E,4298.100098,35.500000,35.329811,20.700001,28.900000,2.019000
4400.000000,12,61,N61.00E,4396.299805,54.700001,54.579338,30.400000,45.400002,2.505000
4600.000000,15,62,N62.00E,4591.399902,97.800003,97.737480,51.900002,82.900002,2.018000
```

1. Create a file with PLAN text format
2. Use Copy & Paste on editing it.
3. Save it.

Notes:

- If you wish use it to import on the app "Directional Drilling Survey **for Mac**", Save it with suffix '**.csv**'

- Use the app “*Directional Drilling Survey **for Mac***” to import Survey Data (MD, Inclination, Azimuth) on CSV Text Format from any source and get the same data file using **iCloud on iPhone, iPod Touch or iPad**.

Directional Drilling Survey – About CSV Files

Directional Drilling Survey

CSV Text Files Format

ATTENTION: Select the same "LENGTH UNIT" used in the csv file before to import it.

Survey Data CSV Files (.csv) Format to import from:

Row 1: " MD ", "Inclination ", " Azimuth " note: (not imported)

Row 2: "md1", "Inclination1", "Azimuth1" note: (Tie-In)

Row 3: "md2", "Inclination2", "Azimuth2"

Row 4: "md3", "Inclination3", "Azimuth3"

Row n:

Notes: 1. The fields can be quoted or unquoted
2. Import Col1 (md), Col2 (inclination) and Col3 (azimuth) ONLY starting from ROW 2.

Survey Data CSV Files (.csv) Format to export:

Row 1: MD,Inclination,Azimuth,Quadrant,TVD,HD,VSection,N/S,E/W,DLS

Row 2: md1,Inclination1,Azimuth1,Quadant1,TVD1,HD1,Section1,N/S1,E/W1,DLS1

Row 3: md2,Inclination2,Azimuth2,Quadant2,TVD2,HD2,Section2,N/S2,E/W2,DLS2

Row 4: md3,Inclination3,Azimuth3,Quadant3,TVD3,HD3,Section3,N/S3,E/W3,DLS3

Row n:

Note: Write the fields unquoted.

for EXAMPLE:

1. Copy & Paste and save to text file
ex. "test for import survey.csv"
2. Import to Default Well
(Length Unit = foot)

```
"MD","INC","AZIMUTH"
"4000","3","50"
"4100","5","51"
"4200","7.5","52"
"4300","10","53"
"4400","13","54"
"4500","15.7","55"
"4600","18","56"
"4700","21","57"
"4800","23","58"
"4900","25","59"
"5000","26","60"
"5100","28.5","59"
"5200","30","58"
"5300","31","57"
"5400","30","56"
"5500","30","55"
"5600","28","54"
"5700","26","53"
"5800","25","52"
"5900","24.6","51"
"6000","25","50"
```

Note: Use PLAIN text format

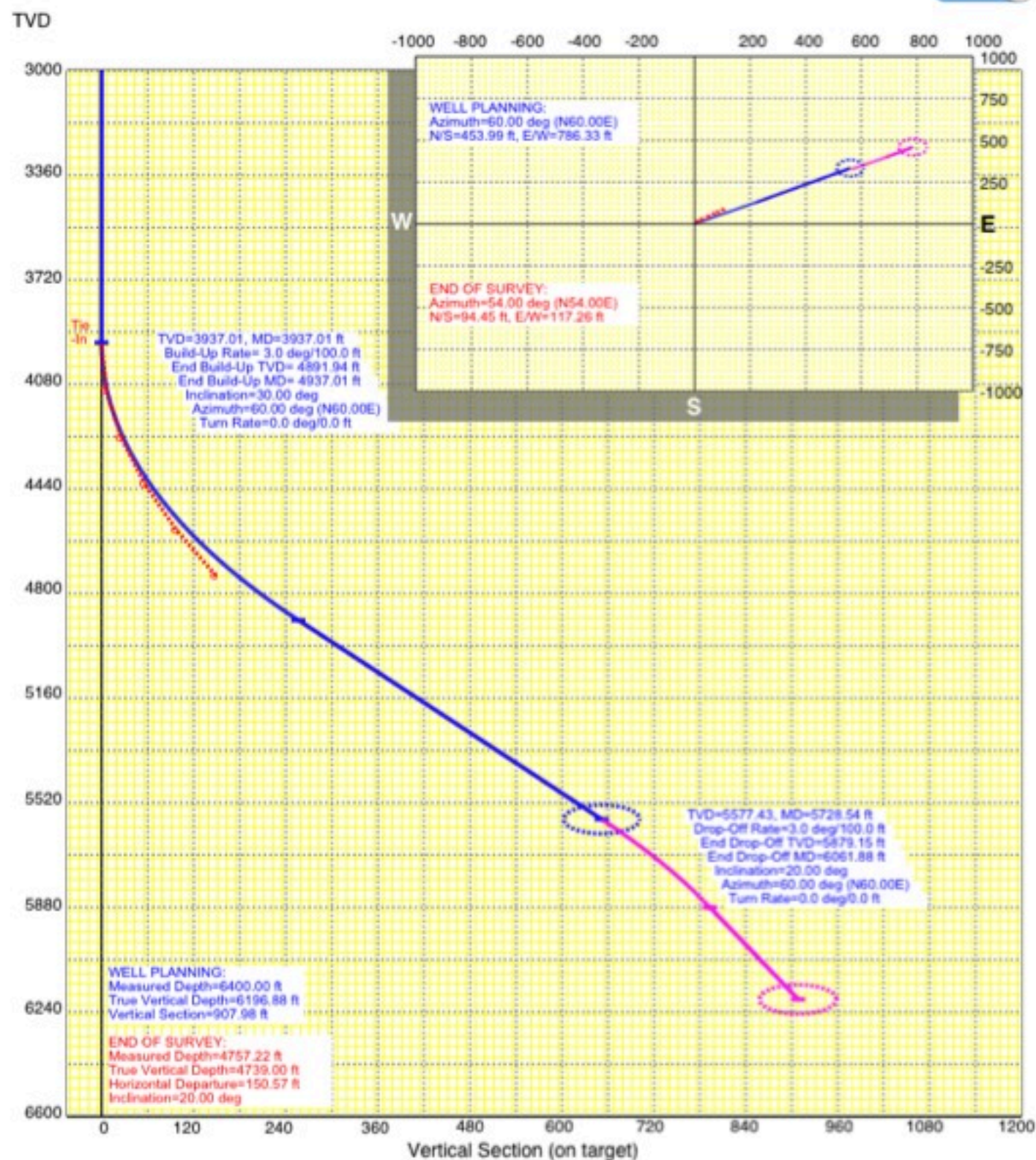
I- Use the 'Print' button to print a screenshot with background color white.



Survey Data

Directional Drilling Survey

Mini Plan View ☒





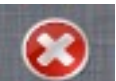
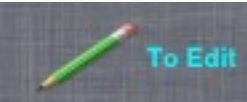
Local: Default Data File 1.ddf

Radius of Curvature Method

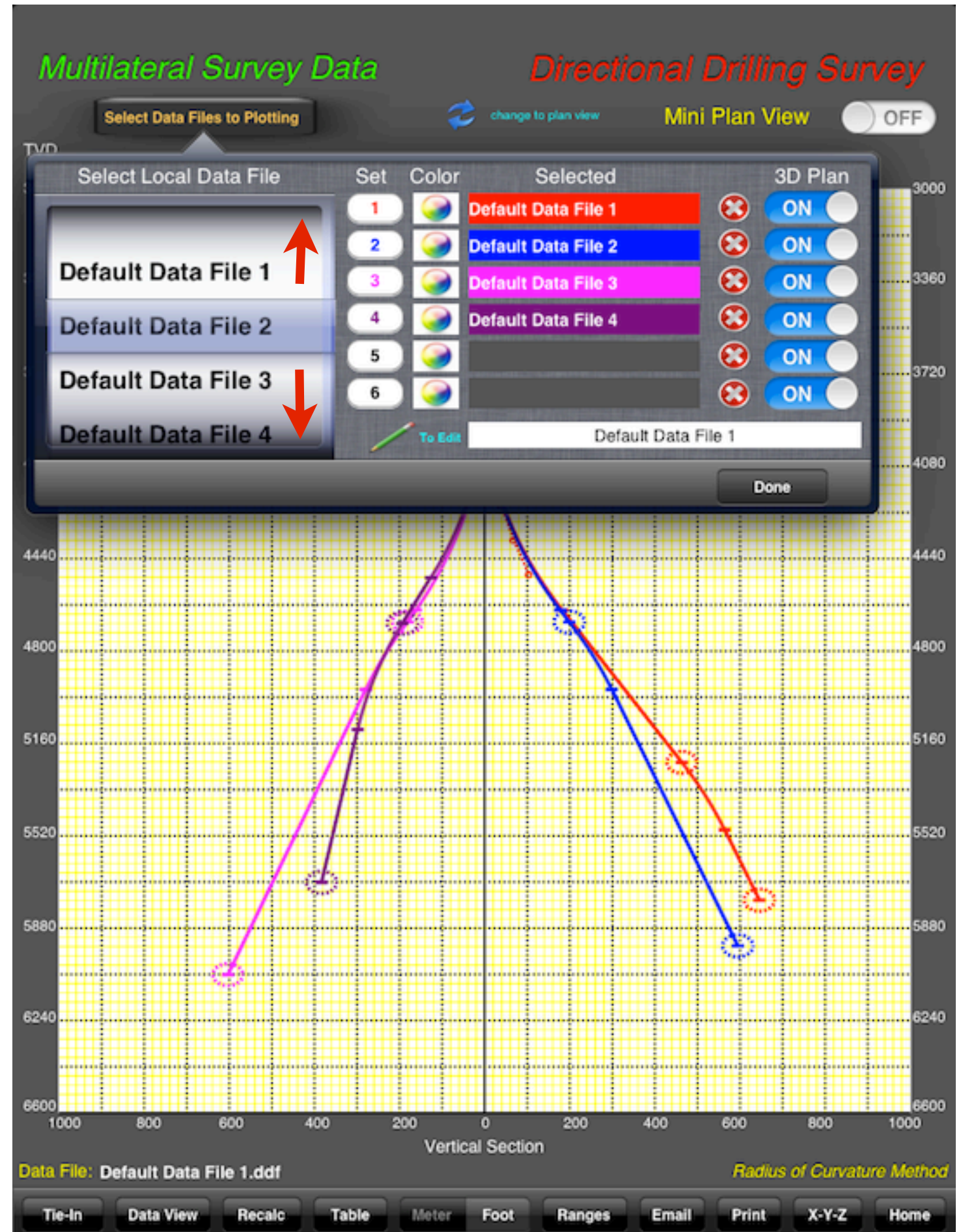
1. [Selecting Data Files to Plotting](#)
2. [Setting Ranges for Graph](#)
2. [Multilateral Wells - iPad on Portrait Position](#)
3. [Multilateral Wells - iPad on Landscape Position](#)
5. [Multilateral Wells - Editing a Data File](#)
6. [Emailing Survey Data Table](#)
7. [Printing Multilateral Wells](#)

Use this feature to plot until six wells.

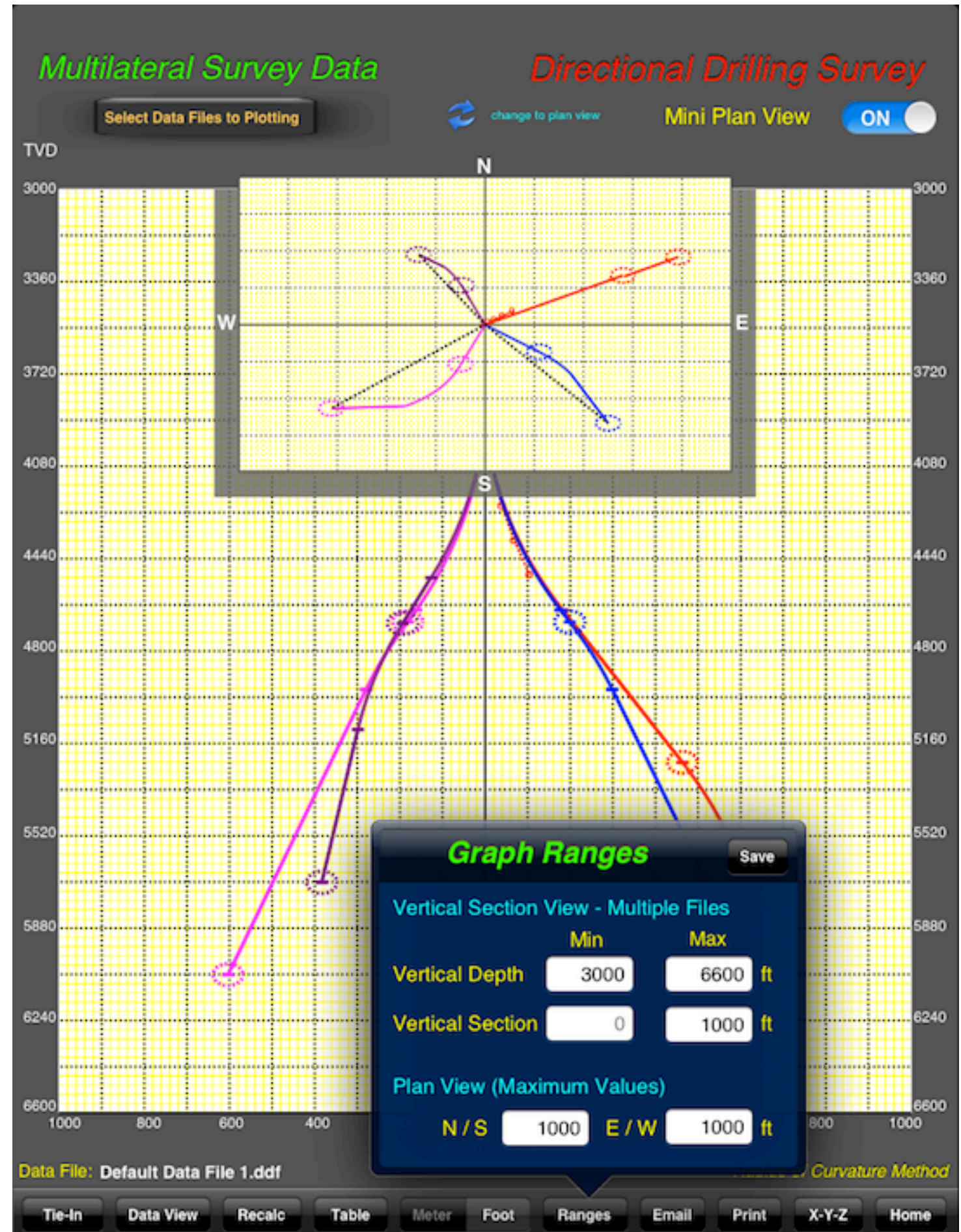
Note: The wells must be located in LOCAL.

- Use the 'Select Data File to Plotting' button
- Roll up/down the wheel and stop on selected
- Tap on 'Set' button (numerical) 
- Tap on  button to select a color.
- Set to show/hide 3D Plan on graph
- Tap on  button to remove a item.
- Set on  to set a data file to edit.

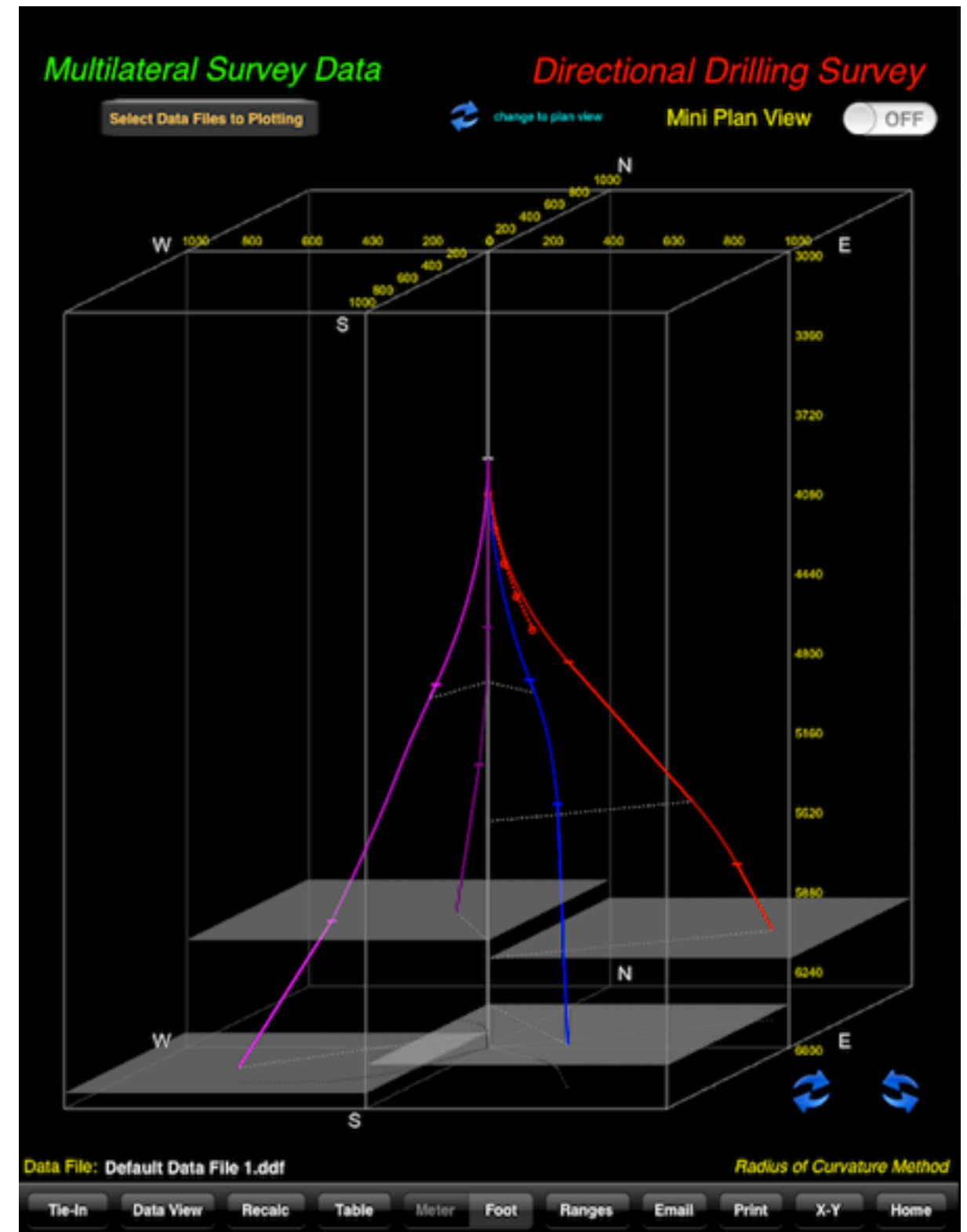
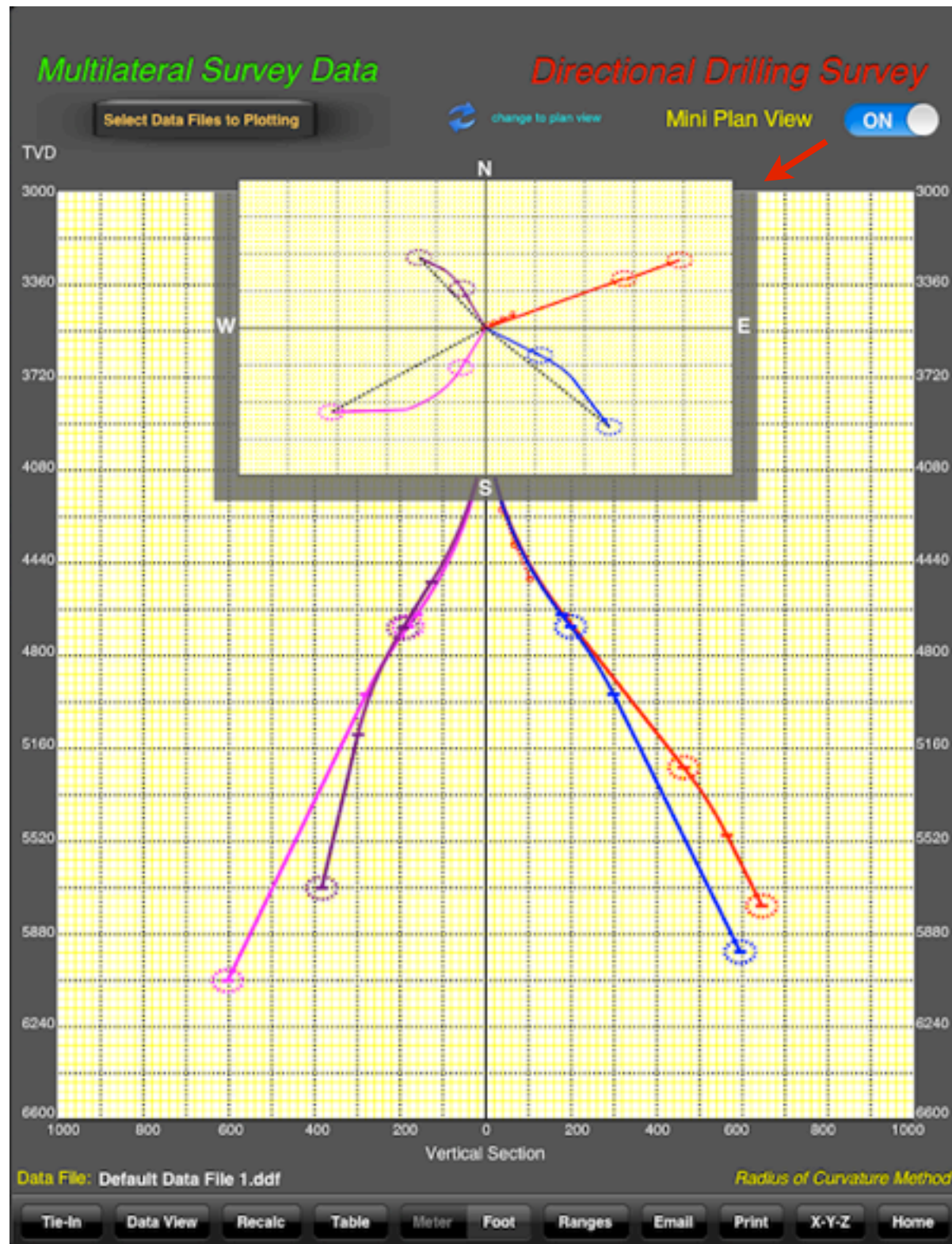
Tap on '**Done**' button to SET and close popup.



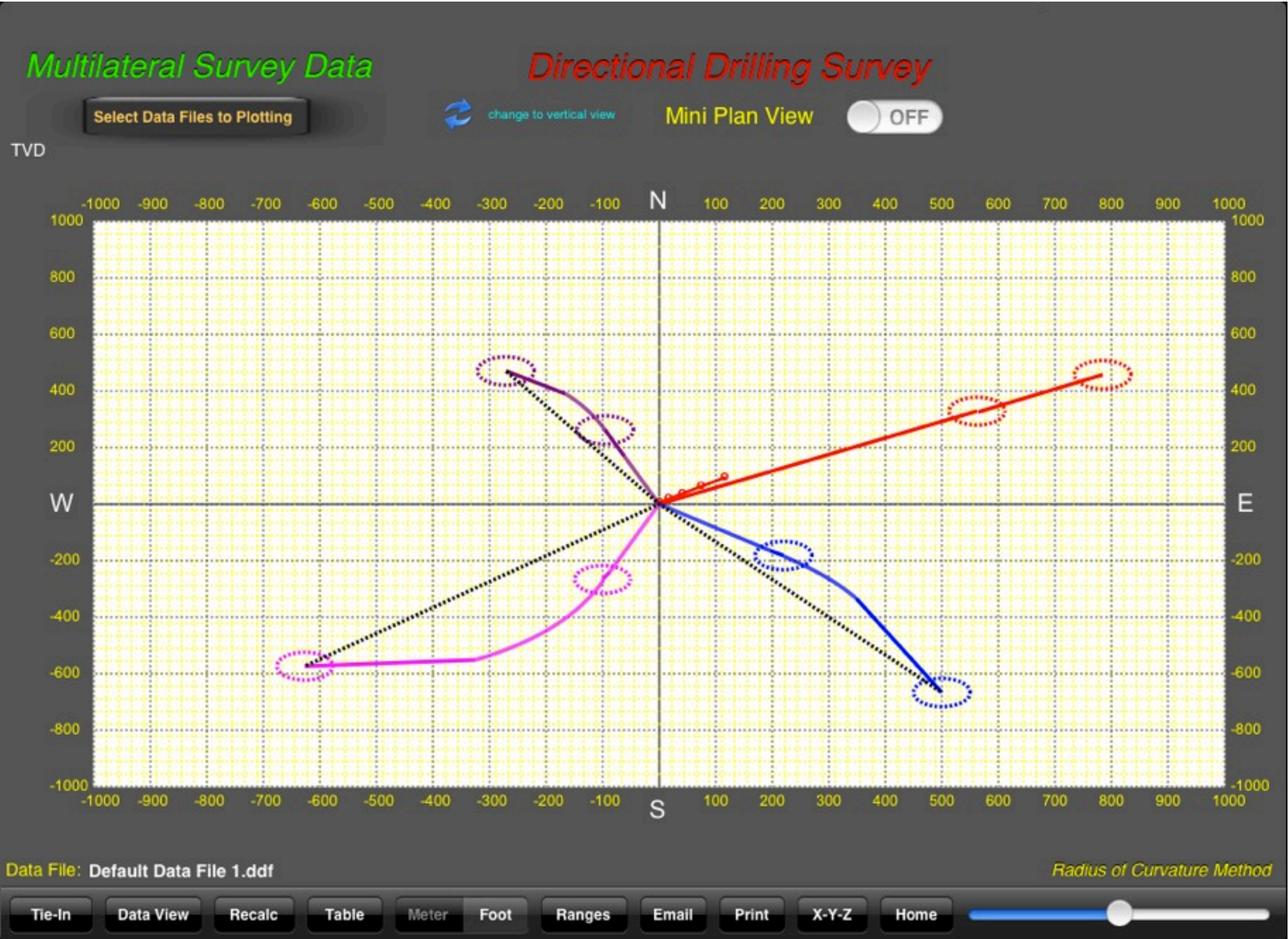
Set the Ranges for better displaying all data files in the Graph



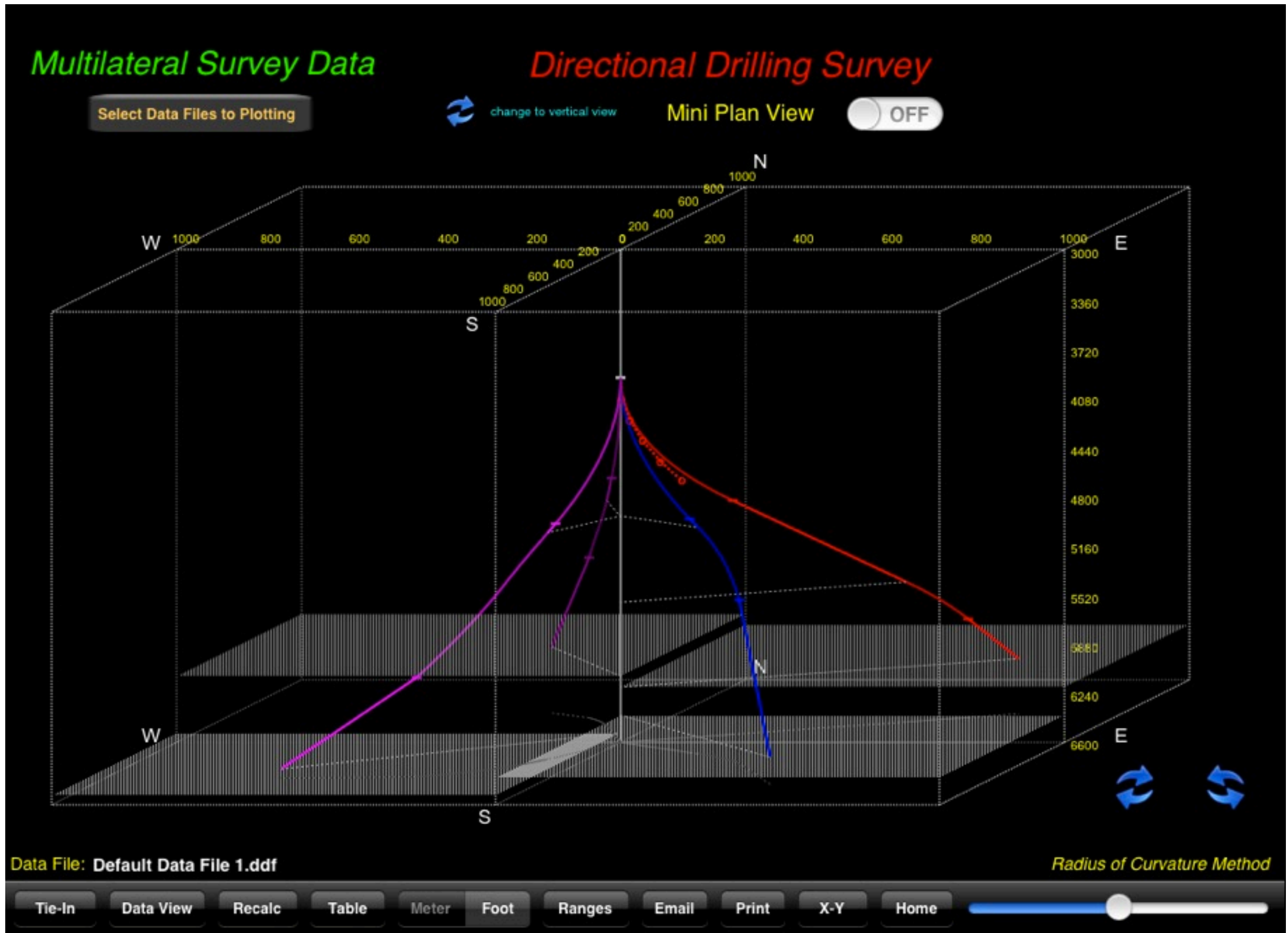
Show the Vertical View and Mini Plan View (optional)



Show Plan View



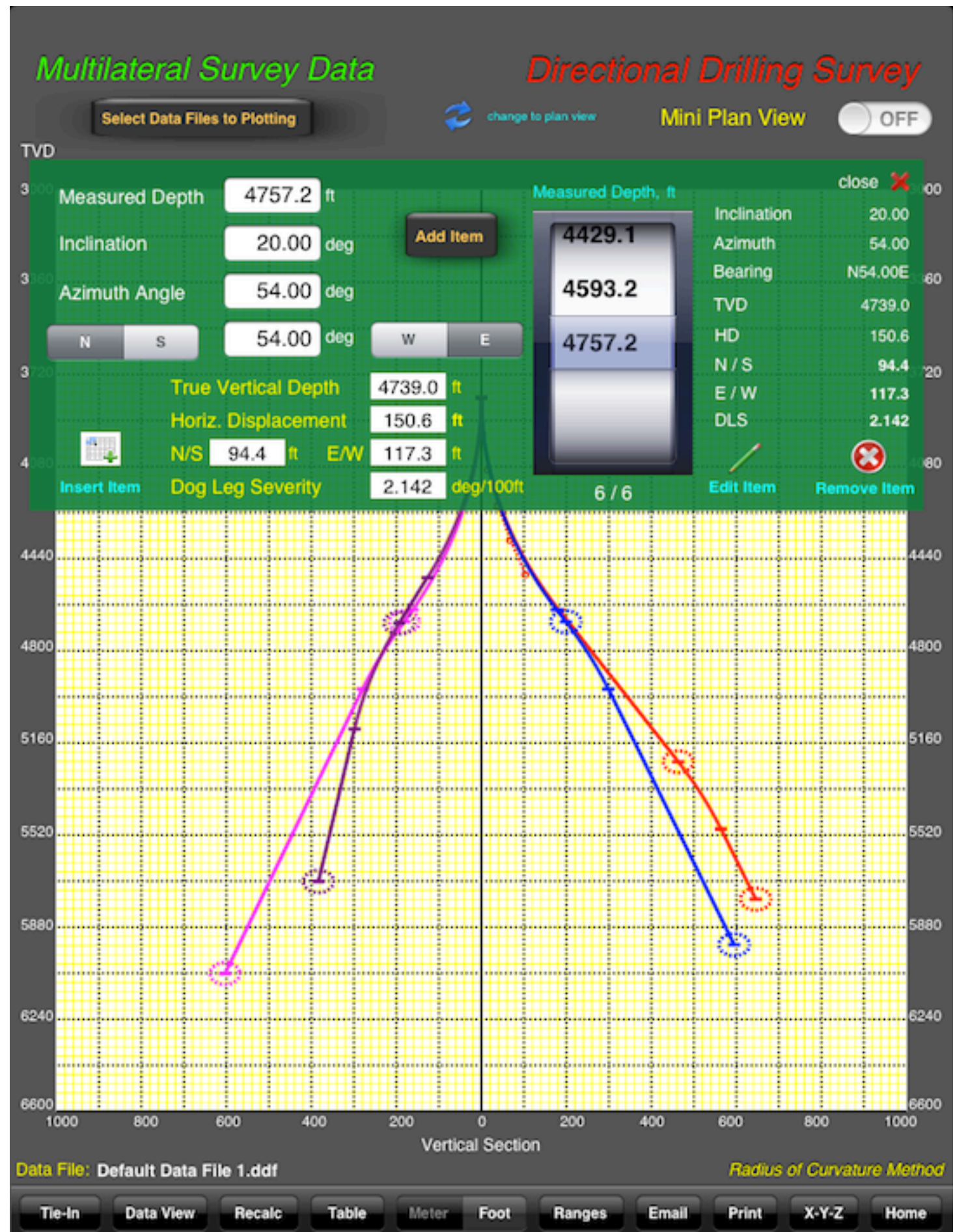
Show Plan View



Use this feature to edit a survey data file selected.

- Use the 'Tie-In' button to set or edit the Tie-In data.
- Use the 'Data View' button to edit the Survey Data.
- Use 'Recalc' button to select the method of calculations of the survey.
- Use 'Table' button to show Survey Data Table.

Data File Selected



I- Use the 'Email' button to send a screenshot by email.

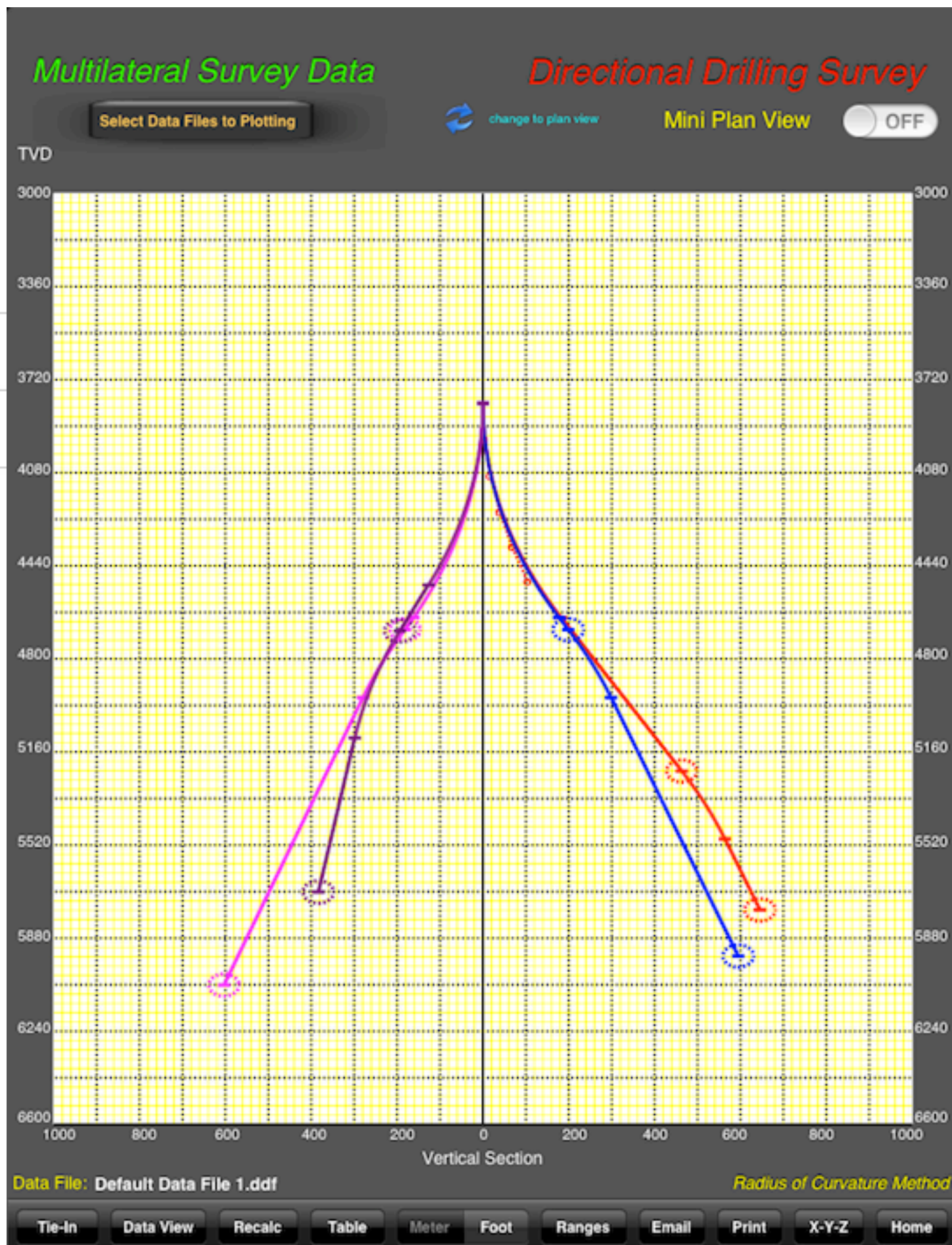
To:

Cc/Bcc:

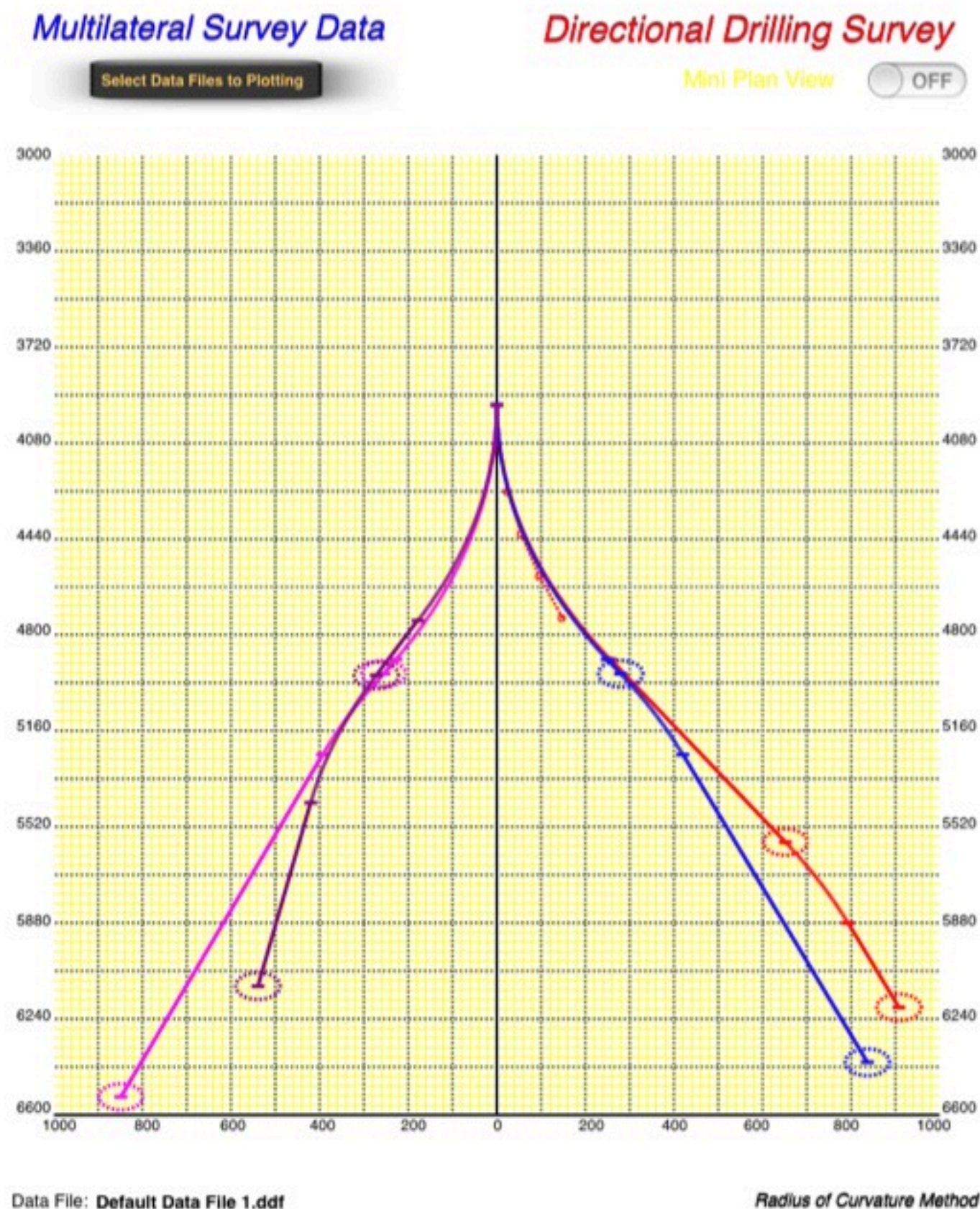
Subject: Directional Drilling Survey - Vertical Section View

DATA FILES:

- Default Data File 1.ddf
- Default Data File 2.ddf
- Default Data File 3.ddf
- Default Data File 4.ddf



I- Use the 'Print' button to print a screenshot with background color white.



I- Use this View to calculate survey between two stations.

Enter Survey Data 1 and 2 and Tap on 'Calculate' button.

Calculations Methods

Survey Data 1

Measured Depth ft
 Inclination I1 deg
 Azimuth A1 deg

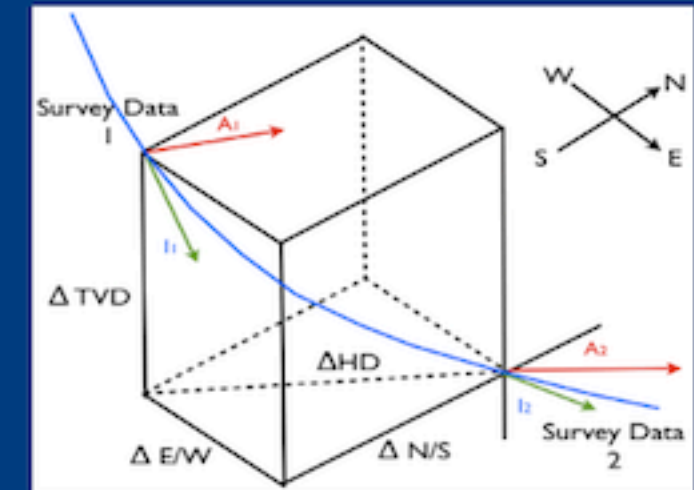
N S W E

Survey Data 2

Measured Depth ft
 Inclination I2 deg
 Azimuth A2 deg

N S W E

Directional Drilling Survey



Calculate

Calculations Methods	ΔTVD ft	ΔHD ft	Δ N/S ft	Δ E/W ft	DLS deg/100ft
Tangential	58.49	74.86	-56.50	49.11	1.0679
Balanced Tangential	62.83	70.80	-49.84	50.29	
Minimum Curvature	62.98	70.97	-49.96	50.41	
Radius of Curvature	62.91	71.03	-49.79	50.66	10.2168
Angle Averaging	62.95	71.15	-49.87	50.75	

Balanced Tangential

Minimum Curvature

Radius of Curvature

Angle Averaging

4) Radius of Curvature Method:

$$\Delta N/S = [\Delta MD \times (\cos(I1) - \cos(I2)) \times (\sin(A2) - \sin(A1))] / [(I2 - I1) \times (A2 - A1)]$$

$$\Delta E/W = [\Delta MD \times (\cos(I1) - \cos(I2)) \times (\cos(A1) - \cos(A2))] / [(I2 - I1) \times (A2 - A1)]$$

$$\Delta TVD = \Delta MD / 2 \times [\sin(I2) - \sin(I1)] / (I2 - I1)$$

Angles in radians. $A(\text{deg}) \times \pi / 180 \Rightarrow \text{radian}$

$$\Delta HD = \text{Square Root} [(\Delta N/S)^2 + (\Delta E/W)^2]$$

DOG LEG SEVERITY (degree/100ft):

$$DLS = \{\arccos [\cos(I1) \times \cos(I2) + (\sin(I1) \times \sin(I2) \times \cos(A2 - A1))] \} \times (100 \div MD)$$

Meter (m)

Foot (ft)

Send By Email

Print

Home

Roll up/down the wheel to select the survey calculation method and to display the formulas

This app was developed based on existing spreadsheets. There was no comparison with any other software.

Our goal was to create a low-cost application with the help of experts to share with directional drilling engineers, technicians, drillers and students.

You can contribute with suggestions for improvements, correcting the translation to english, reporting bugs and spreading it to your friends.

Please visit our support url and see other applications for Oil & Gas for iPhone, iPod Touch, iPhone and Mac OS X.

Contact:
contact@wellcontrol.com.br

Support URL:
<http://www.wellcontrol.com.br>

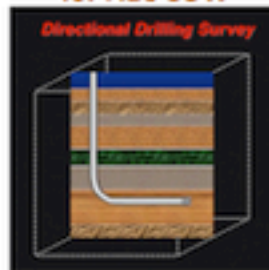


Applications
Well Control Methods
Drilling Hydraulics
Kick Tolerance
Drilling Cost
Directional Survey
Drilling Simulator
Others

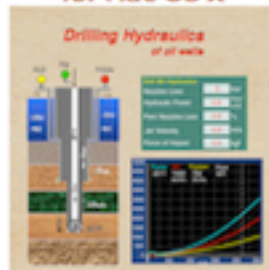
Knowledge
Methods and Concepts

Highlights

Directional Drilling for Mac OS X



Drilling Hydraulics for Mac OS X



Well Control Methods for Mac OS X



A Message to Our Customers

Our app suite sales are impressing us by each day, with satisfied customers buying a product for several devices, trying new ones, recommending to their co-workers and college friends, giving feedback with compliments and suggesting improvements.

We work hard to always bring to you the best experience.

Thank you very much, and welcome!



Enjoy our Apps!

About Us

We are a team of specialists in petroleum engineering with over **24 years of expertise** in oil wells drilling and workover operations. We have in our portfolio **Well Control Simulators** for training and Monitoring Systems for the oil industry.

Our **mission** is to bring petroleum specialists and students **innovative tools** which will provide **safety** and **efficiency** to their work.



News

» Update for Well Control Methods for iPad 2.4 now available on the App Store

» Directional Drilling Survey for iPhone, iPod Touch and iPad 2.2 now available on the App Store

» Directional Drilling Survey for iPad: Single Well Survey (User Guide)

» Directional Drilling Survey for iPad: Well Planning (User Guide)

» Directional Drilling Survey for iPad: Load/Save Data File (User Guide)

» Directional Drilling Survey 2.1 now available on the App Store: Sharing data files with iCloud

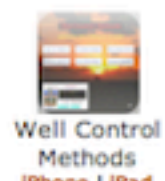
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 iPhone | iPad

iPhone Apps Video

